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August 1984
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RUN

The Commodore 64 & VIC-20 Magazine

Program of the Month—
Take Control of Your Sprites

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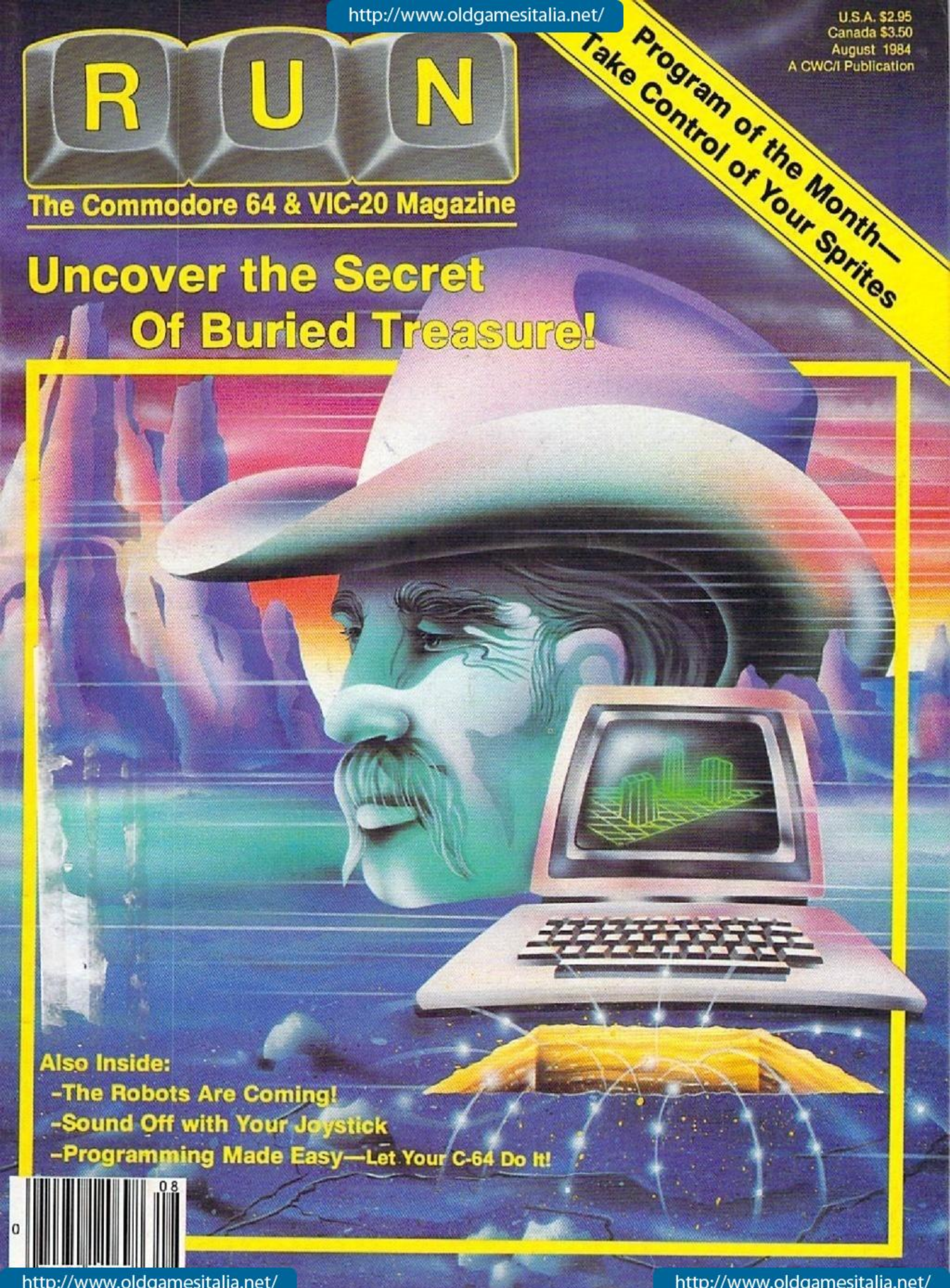

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- The Robots Are Coming!
- Sound Off with Your Joystick
- Programming Made Easy—Let Your C-64 Do It!

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Suggested Retail $66.00 Commodore 64

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Pro-Schedule will make scheduling of employees and labor control a snitch. On-screen math functions show how many hours an employee worked, your expenditure on his labor, overbudget warnings, merging with Pro-Data and Pro-Account. Can be used by employers and employees for time wage and budget tracking. All self-calculating, while you enter data it already shows results.

Suggested Retail: $44.00 Commodore 64

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Clear the zone by destroying the alien, just to find yourself in another more frantic zone to complete.

Suggested Retail $26.00 VIC 20 with at least 8k memory

PRO-ASSEMBLER

Pro-Assembler, the world's first macro-cross assembler for home computers, is now available for Commodore 64 owners. Pro-Assembler supports all major 8 & 16 bit CPU's including the 6502, 65C02, 6510, Z80, 8086, 8088, 68000 & Z8000 3 pass macro-cross assembler supports conditional assembly, base 16, 10, 8 and 2 number systems, leaves all available Basic ram (38911 bytes) free for source text and has label length of up to 255 characters.
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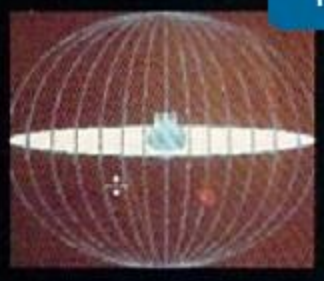

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SEPTEMBER RELEASES

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Finally the compiler you have been waiting for. Full 32 bit arithmetic, during compilation other basic programs or subroutines can be included. A true complier by all means, it does not generate slow P-code or its own library overhead! It compiles your BASIC program right down to the real thing: straight machine code. And while it is doing this, it optimizes your code. Now your compiled program can have up to 48k.

Suggested Retail $99.00 **Commodore 64**
IBM version available early '85

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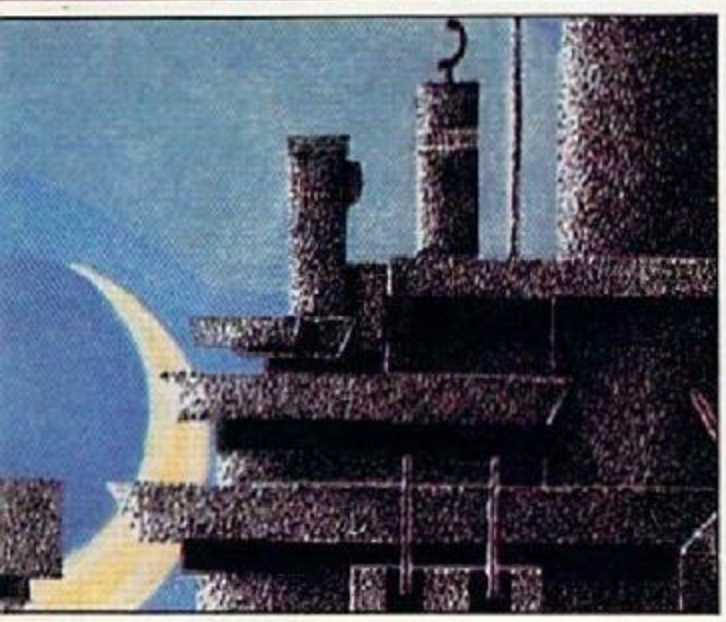

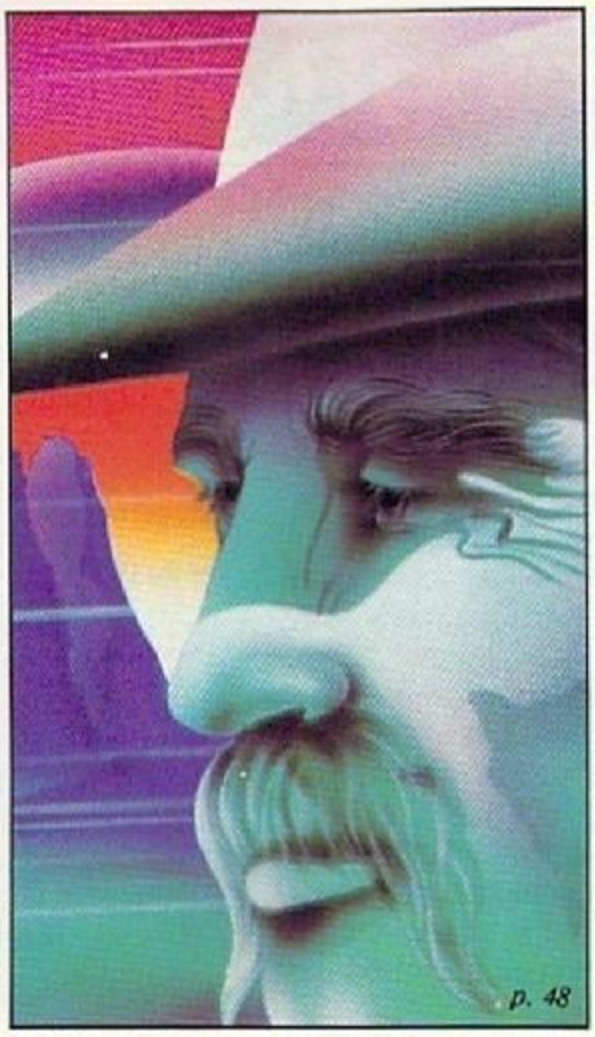

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Cover illustration by Anna Davidian.
Designed by Suzanne Torsheya.

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Colors Challenge

In April we challenged our readers to come up with a program that would display all possible screen, border and text colors in six lines or less. The response was tremendous! Out of the hundreds of people that sent in their solutions, we could only choose a few to publish in *RUN*. The choice was a difficult one.

Here are a few of the answers that we received, chosen not because they were that much better than any of the others, but because they displayed either creative programming techniques or were good examples of the ways in which other people solved the problem. All of you gave correct solutions, but as you can see by some of these answers, computer programs, like cats, can be de-furred in a multitude of manners. (Of the hundreds of solutions we received, no two persons solved the problem in the same way.)

If your solution doesn't appear here, it isn't because you were wrong—it's simply because we did not have enough space to print them all. Perhaps, using some of the tricks these people used, you can better meet the next *RUN* Challenge.

GW
Technical Editor

(Note: In order to enter some of these program lines, some commands must be abbreviated. We have printed the programs exactly as you should type them, with the commands already abbreviated for you. When listed, the lines will appear as if the words had been spelled out. For example, '?' will list as 'PRINT', 'P{SHFT 0}' will list as 'POKE', 'N{SHFT E}' will list as 'NEXT', etc. For more information on abbreviating commands, see Appendix D in your user's guide.)

The Grand Winner! — TBS Colors

```
1 FORI=4TO6:X=642+I-(I<>4)*52633:Y=(P{SHFT E}(X)-(P{SHF
  T E}(197)=I))AND15:P{SHFT O}X,Y:?Y;:N{SHFT E}:?:R{SHF
  T U}
```

The function keys F1, F3 and F5 control this program, modifying the text, border and screen colors (in that order). If you hold down the F1 key, all 16 colors of the text can be seen simultaneously, and if you hold down any other function key, that function will auto-repeat. Three numbers, corresponding to the three colors that are currently being used, appear continuously. If left alone for a few seconds, the text will seem to stop scrolling, but the flickering of the bottom line will tell you that it really has not.

Note: The optional line to stop the scrolling with the space bar: 0 IF PEEK(197) = 60 THEN 0.

Emerson J. Perkins
Westminster, CA

Cleverest-Use-of-GET-Statement Award

For the VIC-20:

```
1 POKE65Ø,128:FORI=ØTO15:FORJ=ØTO7:POKE646,J:FORK=ØTO7:
  POKE36879,(I*16+8)ORK
2 GETA$:ON-(A$="")GOTO2Ø:PRINT"COMMODORE";:NEXTK,J,I
```

For the C-64:

```
1 POKE65Ø,128:FORI=ØTO15:POKE53281,I:FORJ=ØTO15:POKE646
  ,J:FORK=ØTO15:POKE5328Ø,K
2 GETA$:ON-(A$="")GOTO2Ø:PRINT"COMMODORE";:NEXTK,J,I
```

By pressing the run/stop key and printing the variables, the actual values for a pleasing combination can be found. The program will wait until any key is pressed before displaying the next combination. The Poke to 650 allows all keys to repeat automatically, so a key may be held down to rapidly cycle through the colors.

Bob Retelle
Ypsilanti, MI

Machine-Language Award

```
1Ø FORAD=49152TO492Ø2:READM:POKEAD,M:NEXT:PRINT"PRESS B
   ,C,E, OR X":SYS49152
2Ø DATA32,228,255,24Ø,251,2Ø1,69,2Ø8,3,238,32,2Ø8,2Ø1,6
   6,2Ø8,3,238,33,2Ø8,2Ø1
3Ø DATA 67,2Ø8,23,162,25Ø,254,255,215,254,249,216,254,2
   43,217,254,237,218,2Ø2
4Ø DATA 2Ø8,241,238,134,2,24,144,21Ø,2Ø1,88,2Ø8,2Ø6,96
```

Type in this program and save it to disk or tape, as an error in the Data statements could cause your computer to lock up. To change a color combination, type in SYS 49152. Press B to change the background color, E to change the border color and C to change the color of all the characters on the screen. Press X to get out of the color-change routine.

Frederick Simon
Alexandria, VA

Most-Confusing-Solution Award

```
1 ?"{SHFT CLR}":X=5328Ø:J=P{SHFT E}(X):GOSUB2:X=X+1:J=P
  {SHFT E}(X):GOSUB2:X=646:J=PEEK(X):GOSUB2:GOTO1
2 POKEX,J:X$=MID$("{SHFT Q}",-(X<>646)+1):PRINTX$"{CRSR
   LF}";:T$="":GETT$:IFT$=""THEN2
3 V=PEEK(77Ø)+256*PEEK(771)-82Ø:POKE82Ø,96:T=ASC(T$):IF
  T=135THENRETURN
4 V=82Ø+V*-(T=136):SYSV:J=(J-SGN(T-133.5))AND15:GOTO2
```

Press F1 to change the border color and continue pressing this key to view all possible border colors. (To cycle back to a previous color, press F3.) To move on to the Background mode, press the F5 key and once again use the F1 and F3 keys to view all possible colors.

After choosing a color, press the F5 key again to move on to the Text mode. A dot on the screen shows the current color of the text. Choose the text color using the same two function keys (F1 and F3). Press the F5 key after choosing a text color, and you will return to the Border mode. You will remain in this color loop until you press the F7 key, which

(continued on p. 134)

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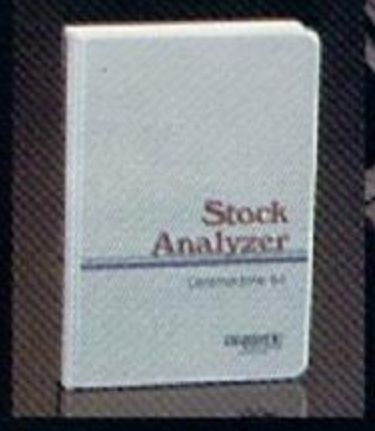

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Commodore Clinic

By Jim Strasma

Commodore Clinic is a monthly column designed to help you, the RUN *reader, through any troubles or questions you have as you use your VIC-20 or C-64 computer. Send your questions along with a business-size envelope to:*

Jim Strasma
Commodore Clinic
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So this column can help as many as possible, please try to limit your questions to topics of general interest, and one question per letter. Including a full-sized stamped, self-addressed envelope usually brings you a reply before your question appears in print.

Software

Q: I load the C-64 WEDGE from the demo disk supplied with the 1541 as follows: LOAD "C-64 WEDGE",8. I then type RUN, and get a Ready display, but when I type any of the abbreviated symbols, I get a Syntax error. Any suggestions would be greatly appreciated.

Robert Lyons
Rensselaer, NY

A: Your Load and Run commands are slightly faulty for this program. Load the Wedge with: LOAD "C-64 WEDGE",8,1 and run it with: SYS 52224.

Q: Could you fill me in a bit about the SYS and Data statements on the VIC?

Chris Anderson
Omaha, NE

A: When used together with the SYS command, the Data statement usually contains a series of numbers separated by commas. In use, these are read into a variable and then Poked into a predetermined part of memory, where they become usable as a machine language program that is activated by the SYS command.

SYS is much like the GOSUB statement, except that the subroutine it goes to (and hopefully returns from) is written in machine language instead of Basic.

Q: In *73 Magazine*, I found the following program for a Timex computer that prints the memory used by the program.

```
520 PRINT "MEMORY USED:";PEEK
    16396+256 * PEEK 16397-16509
```

Is there a similar statement for the VIC?

Jaime Vega
Las Vegas, NV

A: All that? On any of Commodore's computers, simply type: ? FRE(0). (Further notes: 64 owners will get a negative answer whenever they have more than 32K left, and B 128 owners will need to replace the 0 inside the parentheses with a 1 or 2, depending on which bank of memory they are testing.)

Q: In reading some articles, I notice the use of a VIC MON. What is it and how is it used? When do I need one? (Also, I would ask the same questions about an assembler.) Thank you.

Ed Daniel
Prescott, AZ

A: VIC MON is a cartridge sold by Commodore for the VIC. It allows you to list and change machine language programs, much as Basic's editor allows you to view and alter Basic programs. You'll need one only after you know Basic well enough to be aware of its limitations, and are ready to go beyond them.

At Lincoln College, where I teach, students begin serious work with a machine language monitor like VIC MON in their third or fourth semester of programming. As for an assembler, it is a powerful aid to machine language programming. It will become useful to you about the same time as VIC MON.

Q: I bought a 5¼-inch CP/M disk from a Heath user group. I figured it would run with CP/M on the 64, but all I get is a Bad Sector message. I'd appreciate any help you can give.

Del Nelson
Marshall, MN

A: Although all CP/M programs are somewhat compatible once loaded, there are hundreds of incompatible disk formats around, all labeled CP/M. You can't take a Heath disk, put it into a 64 and expect it to work, with or without CP/M. Commodore disks are intentionally not compatible with those of any other brand of computer. (Each company thinks it can do it better its own way.)

Q: I would like to know exactly what a compiler does and how it is used on the 64.

Ron Turner
McAllen, TX

A: A compiler attempts to convert a Basic program into either true machine language, or a separate low-level form known as p-code. The goal is to speed up the program, or hide its lines from prying eyes.

Two good compilers have been around for Commodore systems for some time: DTL Basic, from Drive Technology of England (the 64 version

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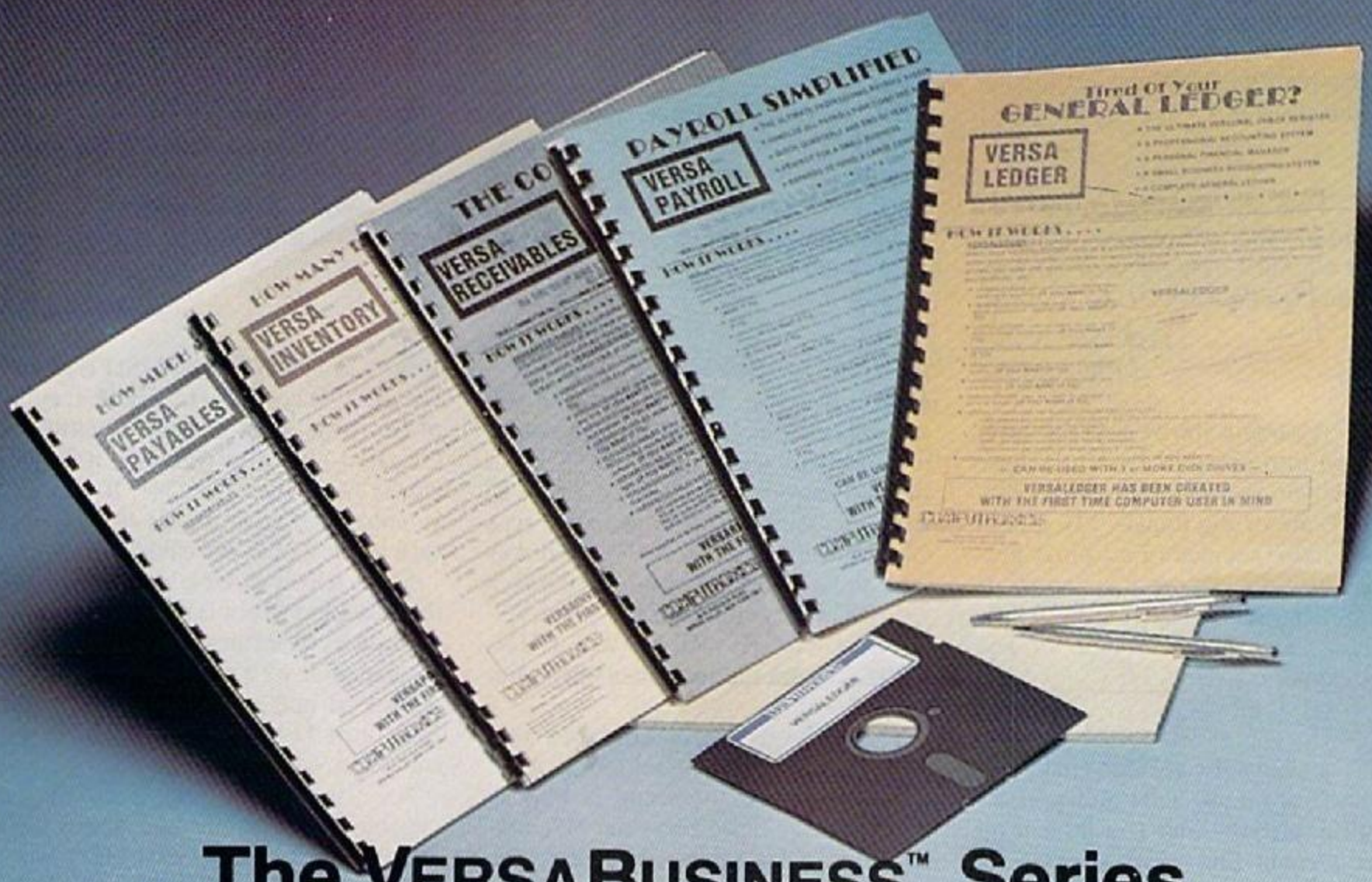

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is reportedly now sold by Cimmaron in the U.S.), and PETspeed, from Oxford Computer Systems, also of England (the 64 version was reportedly bought by Commodore and has recently been difficult to find).

Before buying, be sure the DTL compiler no longer requires a separate $50 dongle (security key) for each computer that runs programs you compile.

Q: I am interested in obtaining astronomical and astrological software for the 64, but I only see such software advertised for the IBM PC or Apple II.

Ferdinand Richey
Phoenix, AZ

A: Assuming you've seen the cover article on astronomy in the March issue of *RUN*, you may want to contact Matrix Software of Big Rapids, MI, an old and reputable supplier of astrology programs for Commodore equipment. (I have not, however, tested any of their programs, and cannot vouch for any supposed accuracy.)

Q: I need software that could process socio-economic data and perform statistical analysis. Can you inform me where I could find good software for this purpose?

Jorge Baanante
Ahoskie, NC

A: One such package was reviewed very favorably in issue 18 of my *Midnite Software Gazette*. It is the Number Cruncher Statistical System, from Jerry Hintze, 865 E 400 N, Kaysville, UT 84037. Another statistical package now under review at *Midnite* is Handic Software's Stat 64 cartridge, which adds several statistics and graphing commands to Basic. You might wish to investigate both products.

Hardware

Q: Why is it that when extra memory is added to the VIC, the memory locations scatter all over the place? Was this problem overlooked when the computer was designed, or what?

Bill Moffatt
Bartow, FL

A: According to Bill Seiler, co-designer of the VIC, the decision to move memory addresses was very intentional. The goal was to allow even buyers of the bare 5K VIC to use all of its features, including hi-res graphics. This required some shuffling.

Q: Sometimes while I'm typing, I'll strike the delete key and the program begins to run, the keyboard locks up, the thing goes catatonic and I can resume control only by shutting down. How come?

R.W. Holland
APO, SF

A: Ah yes, the infamous *push-wrap crash*, which afflicted early 64s. It only happens when editing a long line at the bottom of the screen. To create it, go to the bottom left of the screen, type 82 characters, then press the delete key three times and stand back! If yours is a −01 ROM 64, you'll see LOAD, SYNTAX ERROR, READY., RUN, READY., and the computer will be out to lunch.

There is a way out, and there are temporary and permanent solutions. After it happens, press the 9 and N keys simultaneously. Then press the play button on your Datassette. As soon as the screen goes blank, press the stop key on your computer and you'll be back in business.

The temporary fix is to change your text color to white by pressing CTRL and 2 together. This will last until the cursor color changes again. The permanent solution is to replace your kernal ROM with a current one, available through authorized Commodore service centers. You want a 901227-02 or later ROM for socket U4.

Q: I have just purchased a VIC, and was wondering what special hardware I need to use software cartridges on it, and where do I plug them in?

Victor Swindell
Chapel Hill, NC

A: Good news! You don't need any special hardware at all. Simply buy cartridges marked for the VIC. To plug them in, simply push the long side with the gold-covered fingers (edge connectors) into the longest slot on the rear of the VIC, with the label of the cartridge facing up.

Do all this with the computer turned off. Then, to run the cartridge, simply turn the computer on again. Most cartridges will start immediately, and the rest will include printed instructions telling what to do next.

Q: How compatible is the MSD disk drive with Commodore 64 programs? Will it plug into the serial bus or is an interface necessary?

Doug Shandonay
Gladstone, MI

A: An MSD disk (MSD Systems, Dallas, TX) connects to the 64 in either of two ways. First, it plugs directly into the serial bus. Run this way, it is marginally faster than the 1541. It may also be connected to an IEEE-488 interface card via an IEEE-488 cable.

MSD sells a suitable card, but I use the Bus Card (from Batteries Included), because its phantom cartridge technique is compatible with more programs. MSD disks load and save information about four times faster through an IEEE-488 card than via the serial bus.

As for compatibility, nearly all unprotected programs and about 90% of the protected ones I have tested work properly with the MSD drive. MSD reports it has sent drives to companies whose products are incompatible, and hopes this will be corrected. As always, test the disk and essential programs together before you buy.

Q: I have had the 64 for just over a year, but continue to have trouble plugging in cartridges. Why is it so difficult to insert and remove the cartridge?

Keith Hom
Brooklyn, NY

A: Early on, some cartridge makers didn't size their products for the 64 quite properly. This may explain some of your difficulties. Another reason for tight operation is to avoid at all costs the opposite problem of inadequate contact. As you continue to plug things in and out, the socket will inevitably wear, and eventually fail. Starting with tight contacts delays that sad day.

You may want to get an expansion interface (also called a motherboard) and

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plug your cartridges into that, instead of directly into the 64. It may be easier to fit your cartridges into, and will reduce wear on the original port. One that I've tested successfully is the CB-5, from Cardco, Wichita, KS.

Q: What are the advantages and disadvantages of a thermal printer, aside from the special paper needed?

Gary Payne
Fresno, CA

A: Some advantages of a thermal printer are extremely quiet operation, low purchase cost and compact size. Some disadvantages are the very high long-term cost, difficulty in finding the necessary coated paper and relatively fragile printouts that may become difficult to read after a couple of years.

Q: Should one leave the power supply for the VIC or 64 plugged in when not in use, or should it be disconnected?

C.E. McDougal
Salinas, CA

A: I plug mine into a switched multi-outlet power strip, along with the rest of the computer system, and switch them on and off with everything else. This works very well and avoids the whole problem.

Q: I have a Tandon disk drive that I would like to interface to my 64. What interface would you recommend?

William Douglas
Northglenn, CO

A: This is not a do-it-yourself project. It would be easier to build a 64 from scratch. Commodore's disks are as complex as the computers themselves.

Q: I have a problem with the Check Disk program supplied with the 1541 drive. The program takes so long to run through a disk that I normally give up before it checks 500 blocks. This is not good, as I have had programs lock up when they're loading data and find a bad block.

The symptoms are: the first few blocks take about 1 second per block, but at block 450 it's taking 13 seconds per block; if the program has been running a while and finds a bad block, all the following blocks seem bad; and lastly, I usually give up after two hours, try to load a program, and the program is never found. I believe the problem is with heat in the drive. A fan may help, but how long should Check Disk take? (I'm used to 3 to 10 minutes on other computers.)

Barry Hoefermann
Oreland, PA

A: You've done a good job of investigating the problem. Unfortunately, the results you report are typical for the Check Disk program on the 1541—over two hours to run, and increasing delays as it moves the read/write head further from the block where it keeps its results.

Few 1541s are solid enough to complete the Check Disk program without reporting spurious errors. The then-overheated drive may indeed refuse to load other programs. Adding a fan may ease the problem, but at the cost of introducing more dirt than normal into the drive. Your 1541 sounds heat-sensitive enough to need it.

Avoid the Check Disk program except as a torture test for new 1541 drives. The header (disk NEW) command, which formats disks, already writes to and then verifies every byte on the disk's surface. You will rarely need any further assurance that the disk is good. I've never had a disk that succeeded in formatting suffer an error that couldn't be fixed by reheadering the disk. Also, buy good disks, and replace important ones before they wear out.

Q: I want to be able to do word processing in Spanish and French. I have a Prowriter printer and use the Paperclip word processor, which has a French character set that looks fine on the screen, but I have not been able to print the special French characters.

Hugh Caddess
San Antonio, TX

A: Spanish and French are not among the language options of the Prowriter. Perhaps this would be a good time to add a daisy wheel printer to your system, provided it offers wheels with French and Spanish characters. Or you could trade your Prowriter for one that offers either those characters or a completely loadable character set.

Q: I was wondering if Commodore or any other company makes dust covers for the VIC or 64 and other hardware.

Joe Lind
Yuba City, CA

A: Commodore has announced plans to offer such covers, but I've not seen them yet. The only one I've tested (on a CBM 8032) came from Pro Line Software of Mississauga, Ontario, and is excellent. Several other companies also advertise covers.

Programming

Q: My manual states I should use OPEN 15,8,15,"UI-":CLOSE 15 whenever I turn the disk on with my VIC. Even when I forget, the drive functions fine. Do I have to do this?

Ken Waldrip

A: Only if you need the slight additional speed it adds to disk operations. The 1541 was slowed relative to the former 1540 VIC disk drive to make it compatible with the 64. This command allows VIC owners to regain the 1540's speed.

Q: I want to know how to make a program run off a printed form. I have the 64 and the 801 printer. I don't want to use a word processor to do it.

Fred Jones
Louisa, KY

A: From the form you enclosed, you know how to use the Print statements to make text and graphics appear on the screen. To send the same information to the printer, just change each occurrence of the Print statement in your program to Print#4, instead. (Do not abbreviate this as ?#, and be sure to include the comma after the 4.)

Then, at the start of your program,

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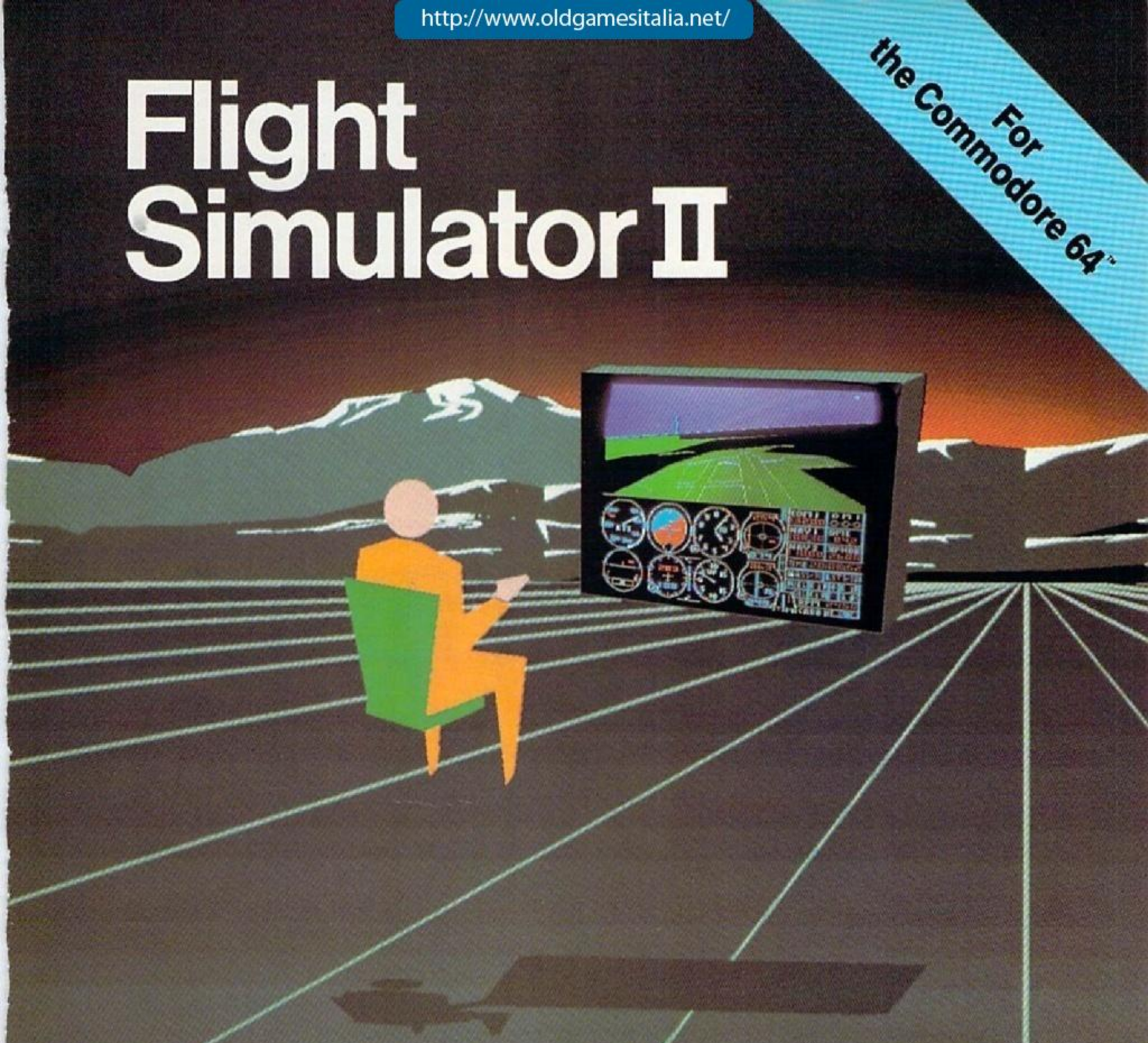

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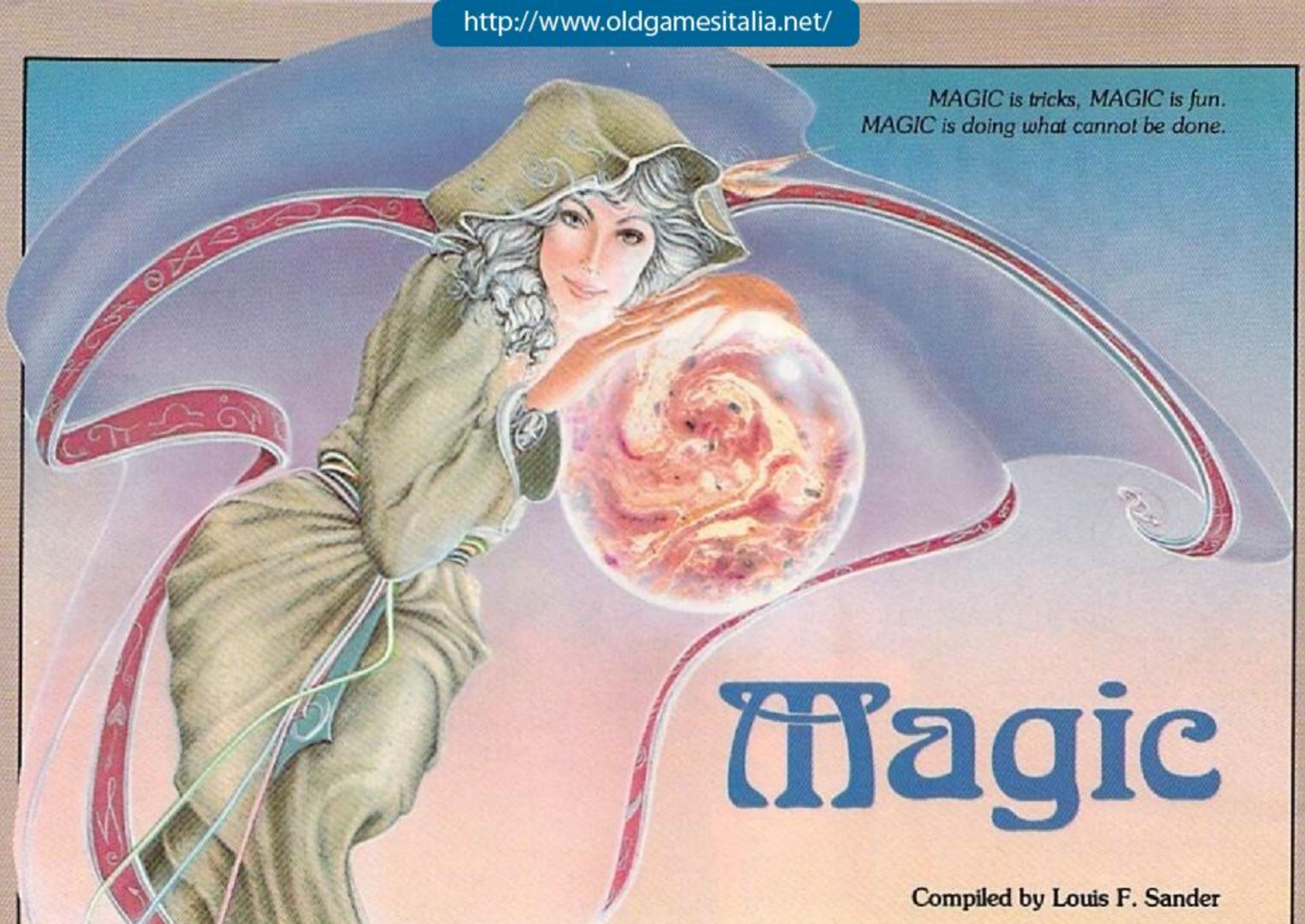

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Compiled by Louis F. Sander

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Back in March, we noted that Magic seeks tricks from diverse geographical locations. By now you can see our sorcery seeking seems somewhat successful—we've printed tricks from every state in the U.S., not to mention an ever-growing group of tricks from other lands. *RUN*'s {CTRL 2} magic seems to have *everyone* under its spell, and the situation shows no signs of {CTRL 9}ing.

Rumor has it that even the astronauts run for *RUN* as soon as they CHR$(13) CHR$(19) from CHR$(32), but of course we have no way of knowing for sure. We *can* verify the answer to last month's word trick: the hidden incantation is somersault.

This month, Atari users gave us some tricks. So did shamans of the Commodore stripe, and here are their august efforts:

$AA Debugging tip—You can check the status of any variable in your program, at any point in the program, by pressing the stop key (*not* stop/restore!), then typing PRINT, the variable name and hitting the return key. The computer will print the current value of that variable. You can print as many values as you need, or even change values, then restart your program by entering CONT.

Michael Berry
Kewanee, IL

$AB Son of BURROW—For an amazing surprise on your C-64 or VIC, try entering POKE 214,30 while in Direct mode. Then hold down the CRSR DN key and watch what happens. Don't worry, the screen will return to normal after you've held the key down awhile.

David D. Panzer
Ft. Knox, KY

$AC Scratch remover—*The 1541 User's Manual* says the following form of the Load command will cause the last program accessed on the disk to be loaded.

```
LOAD "*",8
```

This command is also useful in recovering a program file inadvertently scratched, providing no other programs have been accessed from that disk since the deletion occurred. This worked very well with my VIC-20 and should work equally well for the C-64. To test this trick, try the following.

- Set up a short test program.
- Save the program to disk.
- Execute the Verify command to ensure the disk copy is all right.
- Type NEW to delete the program from RAM.
- Delete the disk version of the program.
- List the disk directory to verify the program has been deleted.
- Type LOAD"*",8
- Type LIST to verify that the program has been recovered.

Now the program is ready to save to disk again.

O. F. Brissette
Pawtucket, RI

$AD Wedge tricks—When using the C-64 Wedge, if you hit the space bar while listing your directory, the scrolling will stop. Hitting the space bar again will resume the listing. Pressing the stop key will terminate it.

To load a program while using the Wedge, just get its directory entry on screen, then press the stop key. Move your cursor to the first position on the same line as the directory entry, then type a slash or an up arrow. Press the return key, and, presto, your program will load. If you used the up-arrow key, your program will run automatically.

Hiram Rivera
Stillwater, OK

$AE Disk buyer's guide—When buying floppy disks, look at the exposed part of the disk around the center hole. Quality disks have a clear or colored reinforcement ring in this area, to protect them from wear caused by the disk drive. Disks without the protective ring might not last as long.

Russell P. Marsella
Lincoln, RI

$AF Making boots—When you want to easily load and execute a machine language program, a small Basic program called a boot can be very helpful. There's a little trick to bootmaking; its necessity is illustrated in the following program, which will never get to line 20.

```
10 LOAD "WAND",8,1
20 SYS49152
```

Line 20 will never be executed because the Program mode Load command causes a program to be loaded, then immediately starts executing whatever Basic program is in memory, retaining the values of all variables from the previous run.

So line 10 will load WAND, then the computer will execute line 10, which will again load WAND and so on, *ad infinitum*. The following program *will* run properly, since it includes a test to see whether the Load command has been executed.

```
10 IF TEST=0 THEN TEST=1 : LOAD"WAND",8,1
20 SYS49152
```

When you type RUN, all variables, including TEST, will be set to zero. The If...Then will succeed, TEST will be set to 1 and WAND will be loaded. When line 10 is executed again, the If...Then will fail, so control will transfer to line 20 and the SYS will be performed.

Errol Lisonbee
Salt Lake City, UT

$B0 More on connectors—Male pc edge connections for the expansion ports can be made from pc bread-boards. For the VIC-20, Radio Shack bread-board 276-152, 44-pin, .156 spacing will fit perfectly.

For the 64, Vector makes a bread-board, 3719-1, which has 72 pins on .100 inch spacing and can be cut down to fit. Another source of expansion-port connectors is blown cartridges (see your dealer).

William C. LaRue
Boise, ID

$B1 Saving machine language—You do not need a monitor program to save a machine language program or block of data stored in RAM. First determine the starting and ending addresses of the memory block you wish to

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save, then add 1 to the ending address. Poke the low and high bytes of the starting address (HI = INT(ADDRESS/256); LO = ADDRESS – 256*HI) into memory locations 43 and 44. (The low byte goes into 43 and the high byte goes into 44.)

Next, Poke the low and high bytes of the end address into memory locations 45 and 46, respectively. Finally, save the block with the usual Basic command: SAVE"programname",8. When the Save is finished, you must reset your computer, since your Pokes have hopelessly upset some important Basic pointers.

J. Winnie
Kila, MT

$B2 Improved automatic Save routine—When you are developing a program and regularly putting new versions onto the disk, you can automate saving *and backing up* by using the following lines.

```
59999 END
60000 PN$="programname":OPEN 15,8,15
60010 PRINT#15,"S0:"+PN$+".BKUP"
60020 PRINT #15,"R0:"+PN$+".BKUP="+
      PN$
60030 CLOSE 15
60040 SAVE PN$,8
```

When you're ready to save your latest version, just enter GOTO 60000. Lines 60000–60020 will rename the previously saved version as a backup, and line 60030 will put the current version onto the disk. Of course, "programname" must contain eleven or fewer letters.

James Llanos
Ketchikan, AK

$B3 Defeating program protection—If you ever try to list a program and the listing terminates suddenly with an empty REM statement followed by a Syntax error, the cause is a shifted L following the REM. You can clear up the list disable by moving the cursor to the colon, then using the space bar to delete the colon and the REM.

Your program should then list perfectly, and unless the program protector was especially sneaky, it should run perfectly, as well.

Paul James
Cleveland, TN

$B4 Printer hint—When you know you will be making a printed copy of a program you are writing, use character codes (CHR$) for such functions as Screen Clear and CRSR DN, so your printout will not be muddled with unreadable black dots.

Screen Clear, for example, would be PRINTCHR$(147). It may cost a bit more memory, but it will make your program easier to read and debug.

D. Mataconis
Piscataway, NJ

$B5 1526 printer tip—One advantage of the Commodore 1526 printer is that it can be used with single sheets of paper. But you may not get as many lines on a single sheet as you do when you use fanfold paper and tractor feed.

When you get towards the bottom of the single sheet, the printer will stop, with the lighted paper advance button flashing an Out of Paper warning.

To get the rest of your lines on the paper, simply slip a blank sheet in the paper feed behind the sheet you're printing to. Make sure the left side lever is set to the friction position and feed the spare sheet as far as you can. Now press the blinking paper advance button. Printing will continue, and you'll have all your lines on a single sheet.

Don Morgan
Parsippany, NJ

$B6 1526 printer tip—When using the 1526 printer and the 1541 disk drive, there is a tendency for the disk drive to hang up with a Searching for XXX message on the screen. Nothing seems to help except turning the system off and back on.

I've found the trouble to be with the sequence in which the various units are turned on. The manuals recommend you turn the computer on last, but if you have this problem, disregard the manuals and turn *the printer* on last. For me, that is the secret to avoiding disk hangups.

Barney H. Roberts
Huntsville, AL

$B7 ML monitor hard copy—The following simple line will cause a machine language monitor's output, prompts and all, to be printed on your printer.

```
OPEN 4,4 : CMD4 : SYS xxxx : PRINT#4 : CLOSE4
```

The xxxx refers to whatever SYS number activates your monitor. When you press the return key, screen output will be directed to the printer instead.

I've used this with Hesmon, Minimon, Micromon, Monitor $0C00, Monitor $8000 and Supermon64.V1, all with excellent results. With Supermon, and perhaps with others, you must first run the monitor, exit back to Basic with the X command, then use the command line above.

Dale Sowell
Senatobia, MS

$B8 Easy Script trick—Working with Easy Script, I have learned to appreciate more and more the power of this program. It even plays music! To hear it, go into Command mode by pressing the f1 key. Once in the Command mode, hold down the CTRL key while you press the 3 key. Incredible!

Steven Cavener
Oklahoma City, OK

$B9 Screen dump—The following short program works on a C-64 with an Alphacom printer, but should also work or be easily adapted to other printers.

```
10 OPEN4,4,7:FORN=1024TO2023:P=PEEK(N)
20 IFP<32ORP>95THENP=P+64:GOTO40
30 IFP>63ANDP<96THENP=P+32
40 PRINT#4,CHR$(P);:NEXT:CLOSE4
```

In the Open statement, the 7 calls for upper-/lowercase mode. An 8 here will print the uppercase/graphics mode. The If...Then statements convert screen codes to ASCII codes.

The program can be typed in or loaded and then run off the screen with the cursor. Compose anything you desire

(continued on p. 118)

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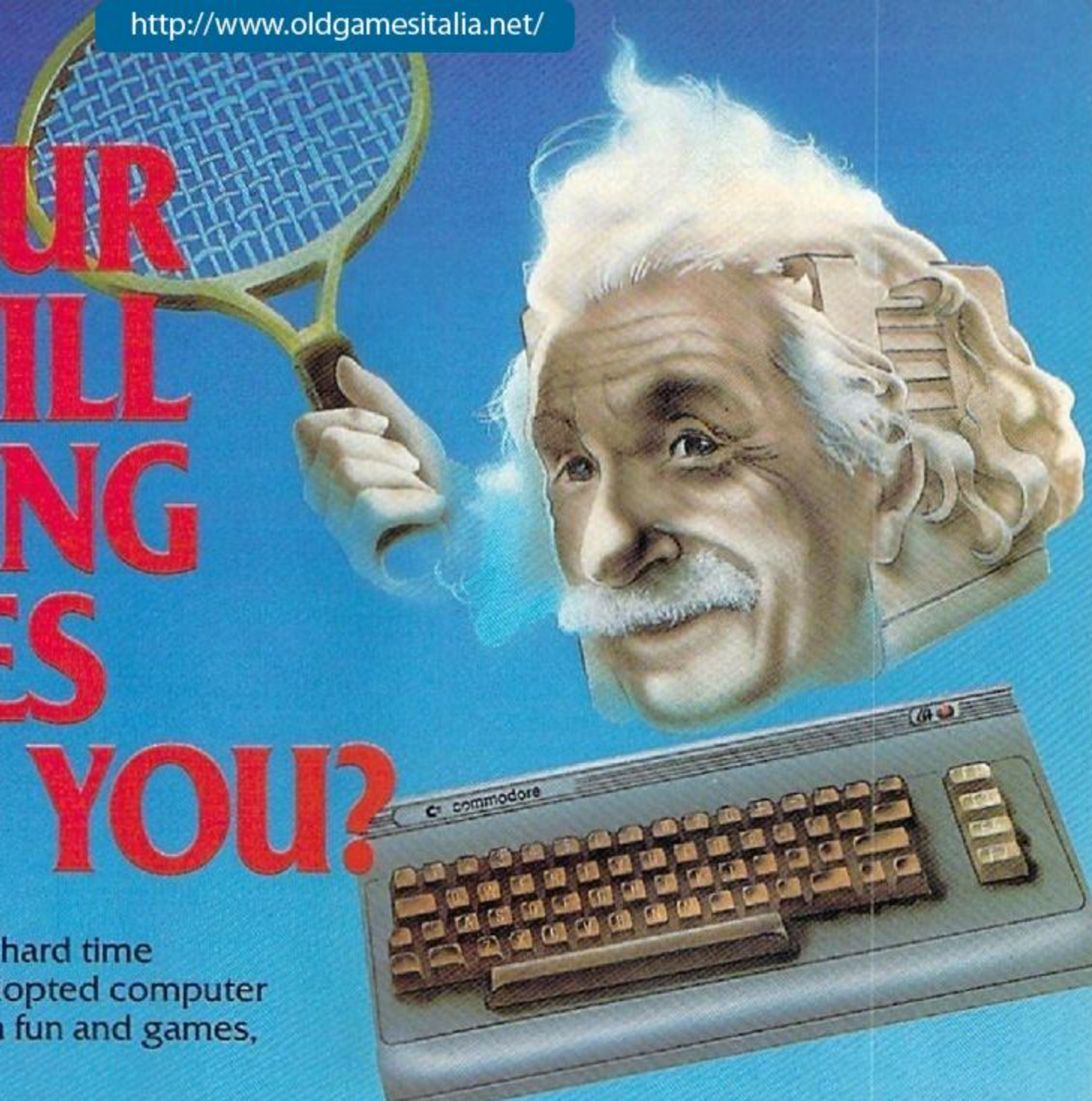

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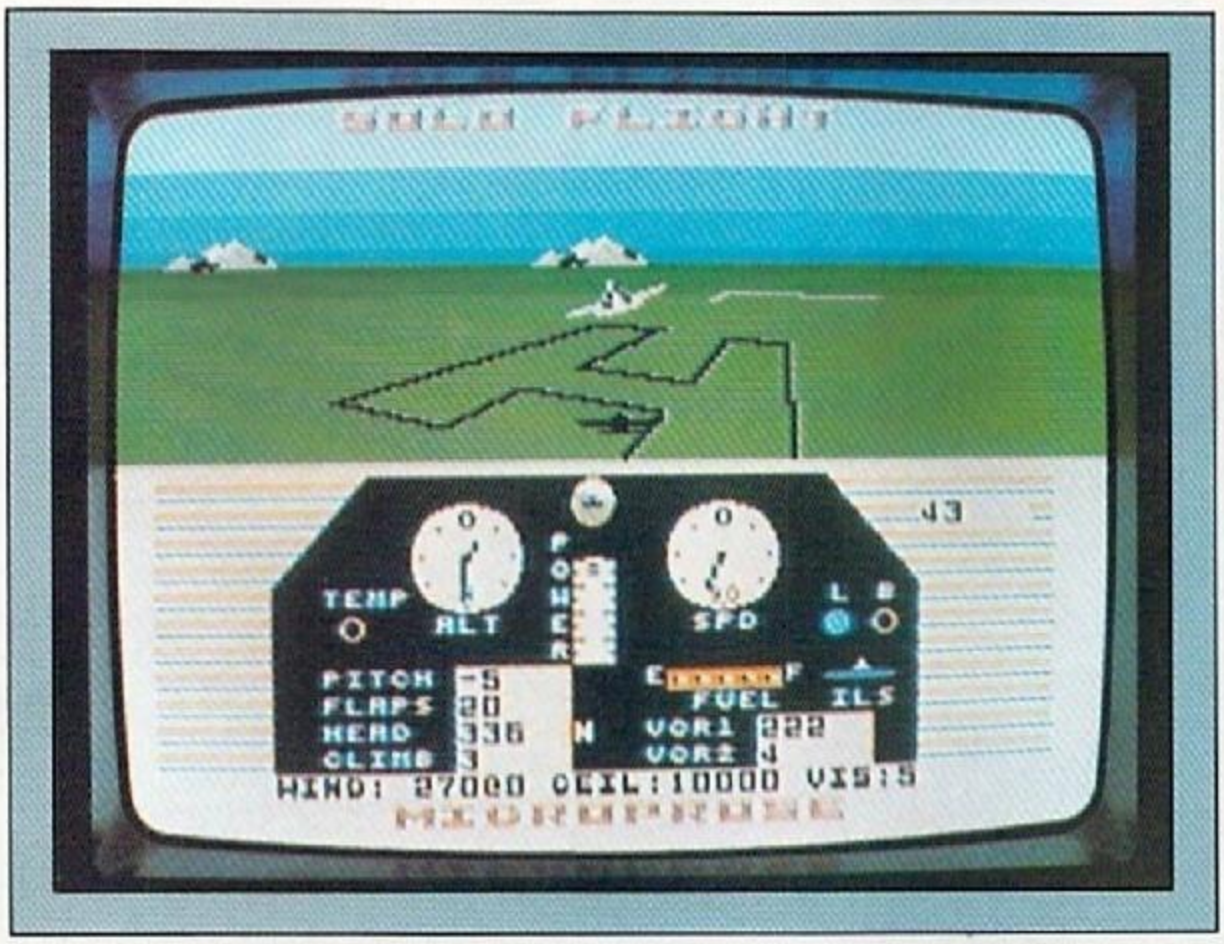
Software Gallery

Compiled by Shawn Laflamme



Report Card

A — **Superb!**
An exceptional program that outshines all others.

B — **Very Good.**
One of the better programs available in its category. A worthy addition to your software library.

C — **Good.**
Lives up to its billing. No hassles, headaches or disappointments here.

D — **Mediocre.**
There are some problems with this program. There are better on the market.

E — **Poor.**
Substandard, with many problems. Should be deep-sixed!

Solo Flight

This New Flight Simulation Is an Elevating Experience For Keyboard Pilots

A

Have you ever wanted to pilot your own plane without having to go through the hassle and expense of flight school? Now that fantasy can be realized with a new release by MicroProse Software. Their excellent disk-based flight simulator, Solo Flight, has everything the average keyboard flyer could want.

Having done a little actual flying in my more adventurous days, I knew that a truly good flight simulator for the Commodore 64 would not be easy to find. The many variables that must be considered by a computer program to produce a realistic simulation would be difficult even for the most advanced computer. I felt that the C-64 had a fighting chance, since it has much of the necessary graphics-handling routines already built in. The missing link was a good programmer who knew what real flying was like. The people at MicroProse knew.

Changing Horizons

Most flight simulators have approached the changing horizon problem in much the same way—that is, by tilting the horizon when the aircraft is turned. This takes hugh chunks of memory and time, factors which take away from the realism of other flying aspects. Solo Flight does it a little differently—they have placed the small plane out in front of the pilot. The plane is then tilted in the direction of the turn. The effect is much like flying a radio-controlled model. It is easier to tell what the aircraft is doing in response to your commands. You get the feeling that you are following behind the plane that you are controlling.

When you tilt your plane, the landscape does not tilt; instead, it sweeps by in an arc below. To add realism to the depth perception, mountains have been added on the horizon that also sweep to the right or left as you turn.

The Instrument Panel

The program puts you at the controls of a vintage, single-engine plane. Even retractable landing gears and flaps are provided. Two Navcom radios continuously plot your position by reading two separate VOR beacons, and the control panel has an artificial horizon, an instrument landing system (ILS), a digital compass, an altimeter, an airspeed indi-

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Whether you're a novice or old pro, Solo Flight has so many features that it may take months to master.

cator and a throttle-setting dial. Several indicator lights and digital readouts on the panel provide you with information on your flap setting, landing gear and brakes.

The Controls

Your plane is turned with the joystick from port 2. Moving the stick to the right or left results in a bank of the plane in the desired direction. Back pressure on the stick raises the nose of the plane; the altitude starts to increase and the landscape drops away. The keys numbered 0 to 9 control your throttle. If not enough throttle is given, the plane will slow to a stall and rapidly nose-dive once flying speed is lost. To make the simulator more realistic, motor sound has been added. Many experienced pilots use the sound of the engine as an indicator of airspeed. If you aren't watching the panel and start dropping altitude, the motor sound will alert you as the pitch begins to increase.

Options

There are several options and difficulty levels available before takeoff. You can choose one of three different states: Washington, Kansas or Colorado. The terrain and elevations are quite different in each location. Kansas, of course, is flat and the runways are long and wide. This is a must for first-time practice. Colorado has short runways and high mountains. The manual gives excellent maps for plotting your course.

I usually choose the novice (student) level, since the more advanced levels can present you with unexpected emergencies, ranging all the way from turbulence to a stalled engine. You can also choose the weather conditions: windy, clear or instrument (IFR). IFR allows you to take off under clear conditions, but your view starts to fade as you hit the low cloud ceiling. You can either fly in the clouds by referring to your instruments, or you can attempt to get above them. There is also an option for practicing landings.

Takeoffs

Takeoffs are started using full power down the runway. You must reach flying speed (85 mph) before you pull back on the joystick. Your wing may drop if you rotate too early, and ground loops are possible. Lifting off the ground is a great feeling—it gives you that special thrill known only to those who have actually flown. A touch of the L key retracts your landing gear, and your speed increases as the little wheels on the plane disappear! What's even more amazing is that you can press the cursor keys and look out any of the windows, including the rear. I like to watch the runway sinking below me as I look back. As you make a turn, you can watch the runway out of the side window.

Cross-Country Flying

For flying cross-country, distances have been shortened so that you are never more than three to five minutes away from your destination. This is still enough time to get completely lost if you don't pay strict attention to your heading and the VOR readings. When flying in Colorado, you must constantly check your charts, since your altimeter reads sea-level zero, and elevations in Colorado change drastically. You can smack into the ground even though the meter is reading 2000 feet! Mountains appear and get closer as you fly toward them; they are shown as three lines in a pyramid shape. Mountains can be easily avoided in clear weather, but under instrument flight rules, they can be deadly.

Flying over the colorful landscape provides a good simulation of real flying. Farms (appearing as gray squares), VOR towers and an occasional runway are visible in the distance. The movements and 3-D perspectives are handled well here. The screen is updated only twice each second, causing a bit of jumpiness, but this is soon forgotten as you concentrate on your controls and indicators.

In Solo Flight, all variables and controls interact with each of the other aspects of flight. Low fuel, for example, causes the engine to quit. Loss of airspeed causes a decrease in altitude. High altitudes make the controls sluggish. Turns must be coordinated with a little up elevator to keep the same altitude. If the engine is kept at full power for a long period, it will overheat and quit.

Landings

If you manage to make it to an airport, you may find the task of getting down to be the most difficult of all. The good graphics and distance perspectives will help, but the actual landing is up to you alone. It has to be rather precise—there's not a lot of margin for error. You should have some power since stalls are easy when trying to hold the nose up. Keep your wings level, watch the glideslope, put your landing gear down, ease back power (not too much!) and add a little back pressure for the flair out. Don't worry—the runway is longer than it looks. Now touch the brakes and you're safe.

Mail Pilot

In the game Mail Pilot (on the Solo Flight disk), you are a mail pilot who must deliver bags of mail to various cities. If you load too much fuel and mail, you may not make it off the end of the runway. If you are lucky enough to drag yourself up with a full load, the engine can rapidly overheat. It's a fascinating simulation, giving you points for time between delivery, your route planning and landings. After each delivery, your flight path is plotted on the map to keep you advised of your progress and to aid you in planning the next leg.

Summary

Although this simulator is not FAA approved, it is real enough to earn you a few points with your flying instructor. It will teach you to use the VOR coordinates, which in itself is worth the price of the program.

If you buy Solo Flight, be prepared to stay at the controls for at least a week. It has so many features that it may take months to master the program. It is an excellent buy, and a real joy for novices and old pros alike.

Now let's see...where did I put my charts? I'm due in Aspen in five minutes! *(MicroProse Software, 10616 Beaver Dam Road, Hunt Valley, MD 21030. $34.95.)*

Jim Stephens
Nashville, TN

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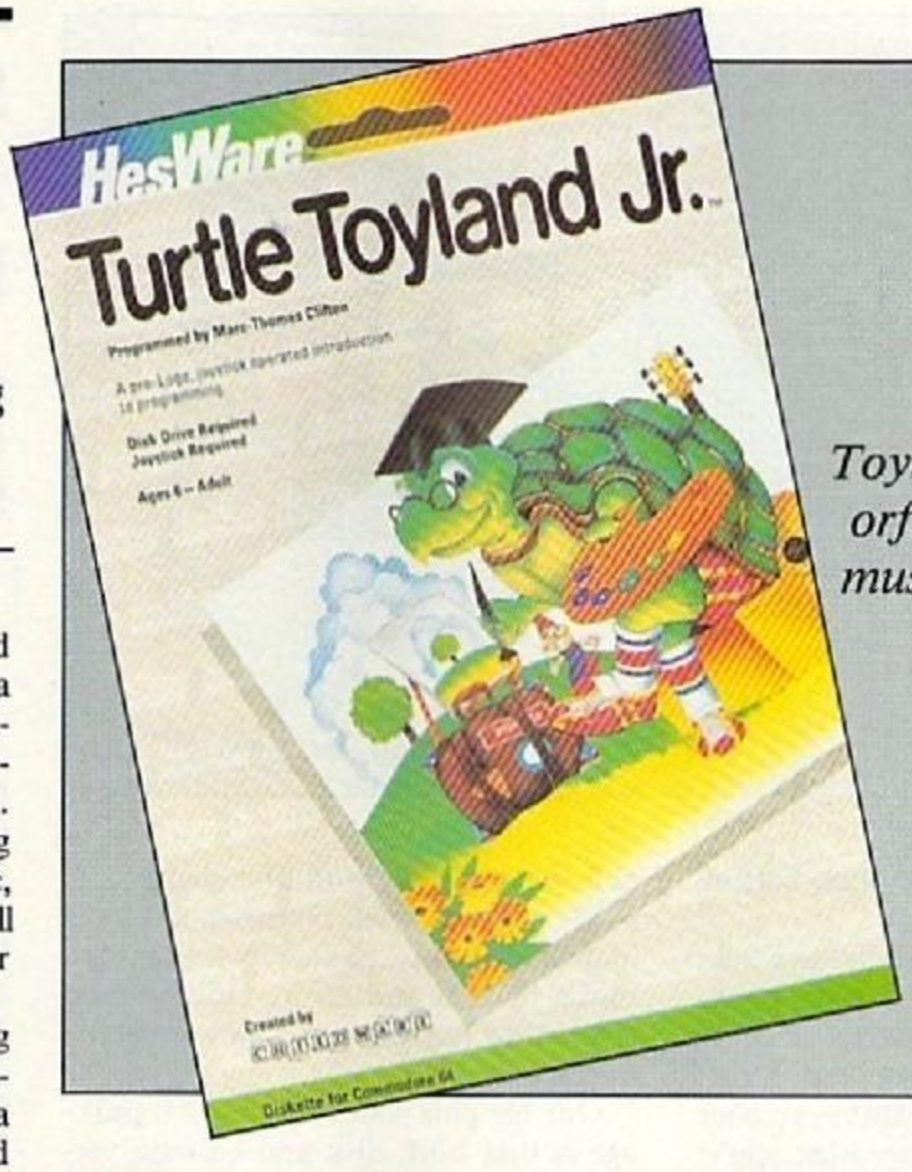
Turtle Toyland Jr.

This Multifaceted Program Offers a Playful, Creative Approach to Computer Learning



Toyland Jr. is a colorful program with music, drawing and even animation.

The child receiving Turtle Toyland Jr. is like the proverbial kid in a penny candy store, staring in anticipation at the many choices available before deciding upon the first selection. Toyland Jr. is a colorful and exciting learning/game program with music, drawing and even animation, and it will provide many hours of creative fun for children and parents alike.

Turtle Toyland Jr. is not something you can jump into and understand completely the very first time you try it—a certain amount of time, effort and learning are required. If you or your child require instant gratification, you're likely to be disappointed. But if your child is inquisitive and willing to try new things, then forge ahead!

The manual advises parents to try the program first alone, and then later let the youngsters loose on it. That way you can explain it all to the poor dears should they falter. This isn't how I approached it, though. Why? Because Toyland Jr. is almost "too friendly" for an adult. Although the manual does use words to explain, you must still rely heavily on numerous symbols (called icons) to do anything with this program. (This is rather alien to me, but apparently not to my five-year-old son.)

It's tough to explain the program briefly because of the many options available, but here's a quick look at it. After loading the program from tape or disk, you are treated to a short and brilliantly colorful intro. Then, a box labelled Learn and another labelled Program appear on the screen. The turtle is flashing in the Learn box, but you can use the joystick to move him into the Program box, if you wish. Try the Learn mode first by pressing the joystick button. Now you or your child will receive some basic joystick training.

Learning to "Turtle"

Your joystick controls the movement of the turtle. I love the graphics of this program, especially the turtle. His feet and tail move as he walks, and he really does look like a turtle. A musical note is played every time the turtle moves.

Several exercises are provided in the Learn mode, to give the child practice with the joystick and familiarize him with the movement of the turtle. It's good training for a child unaccustomed to the joystick. This is important, since joystick control is an integral part of the program. In fact, according to Human Engineered Software, "by allowing nearly complete control of the product through the joystick controller, the need for keyboard skills is virtually eliminated."

Advanced "Turtling"

Moving to the screen labelled Crossroads, your available options are represented by symbols: Training Land (turtle), Music Land (musical note), Sprite Land (bug), Toybox (box with four squares), I/O Land (floppy disk) and Playground (diamond). Move the joystick until you reach the icon you want, then press the joystick button.

From now on, you're into heavy symbolism. At the bottom of each screen you'll see at least four symbols. Every time you want to use one of them to make your turtle draw, play music or whatever, you must pull back on the joystick to get into the menu mode. Then move onto the right symbol and push the joystick button.

Let's say your child has decided to try Training Land. In this part of the program, the menu at the bottom of your screen depicts a turtle for drawing, a crossroads sign, a paint pot to change your colors, a box to change background color, a box to change border color, an eraser to eliminate the last few commands, a trash can to erase everything and finally an arrow to turn your pen on or off or change its width.

My son decided to use very wide purple strokes to create a huge, scrawly drawing. He pulled back on the joystick to get into the menu. Then he moved the cursor over the paint pot and pressed the joystick button until the pot turned purple. He moved to the pen arrow and pressed the joystick button until he was satisfied with the width displayed. Next, he moved the cursor back to the turtle and pressed the joystick which got him back to the screen. After

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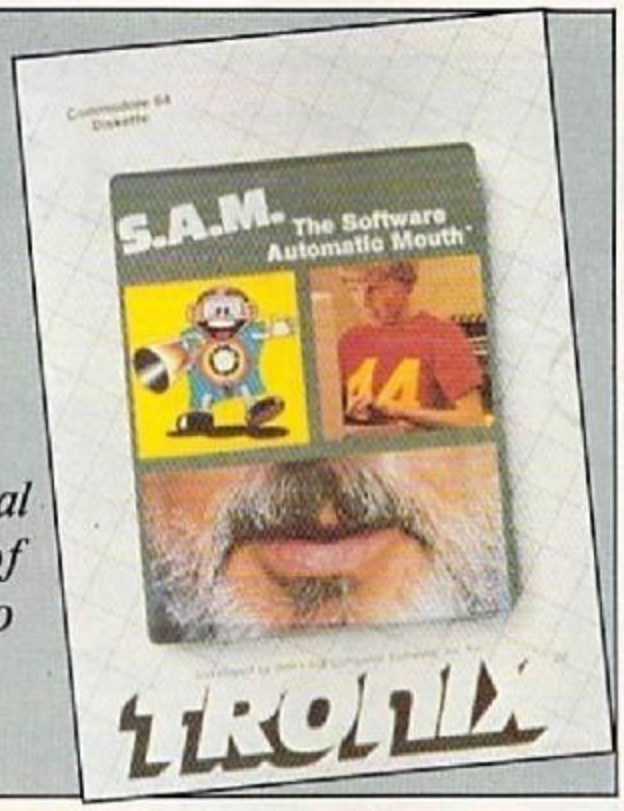

SAM requires no additional hardware. He comes out of the box on a disk, ready to talk.

one more press of the joystick button, he began drawing.

If you want to temporarily save your drawing, you must go back to the Crossroads. From there you can move on to the Toybox, where music and sprites can be stored. You must always go back to the Crossroads to change what you're doing. "You can't get there from here," unless you go to the Crossroads.

In Music Land, you can select from a piano, horn, guitar or flute to create your own tunes. This is not a program for a budding Beethoven—the range is somewhat limited, and you may find the joystick a little awkward. However, it's still a lot of fun as well as a valuable learning experience. When you have finished composing, you can go back to the Toybox via Crossroads and save your music.

What if you'd like to create your own sprites? That's possible too in this amazingly multifaceted program. In Sprite Land, you can create your own sprites and ultimately build your own little filmstrip, with music, brilliant color and animation. There's a clock for timing, a function for selecting angles, and several other rather sophisticated options.

Pluses and Minuses

The manual explains the program in general terms, but I still had to read it several times while running through the program before it made any sense to me. Human Engineered Software now includes a Joystick Controller Quick Reference Guide that explains the available moves in the form of a chart.

My son never felt constrained by his inability to read—he rapidly learned the basics by trial and error. However, he still had to rely on me to look up some of the symbols.

One big plus with this program package is that both disk and cassette versions are included for the usual price of one. So, if you own both a disk drive and cassette player, you can use the tape for your emergency backup or give it to a friend. If you're limited to tapes, you can give the disk away or save it in case you decide to add a disk drive to your system.

Conclusion

Turtle Toyland Jr. is recommended for children ages six and up. "It's not a throw-away product; it's something a child can enjoy at age six and still love at age ten," explained Dr. Sueann Ambron, Director of Educational Software at Human Engineered Software. I agree. Like all good programs, this one grows with you. In fact, of the 25 to 30 children's educational programs I've seen, this one is the best.

Perhaps my son and I will create something gorgeous together—this is a program to share! Turtle Toyland Jr. is like starting off with lemon drops and working your way up to fancy petits fours! If you're a parent, I strongly recommend that you try it. *(Human Engineered Software, 150 North Hill Drive, Brisbane, CA 94005. $34.95.)*

Christine Adamec
Palm Bay, FL

Software Automatic Mouth

Give your C-64 the Gift Of Speech with This Software-Based Synthesizer

B

The Software Automatic Mouth (SAM) is a completely software-based speech synthesizer for the Commodore 64. No additional hardware is needed when you use SAM. He comes out of the box on a standard disk, ready to talk. Actually, you get several programs with the package. SAM is the bare bones speech synthesis program. The SAM Wedge patches some additional commands into Commodore Basic.

After the program is loaded, simply issue the command SAY, along with the desired message, and your C-64 will begin speaking to you. The speech is for the most part quite clear, but it does have a rhythm that might remind you of a Norwegian fisherman.

Using nothing but SAM and the SAM Wedge, you must use phonetic spelling to input the words you want SAM to speak. In this mode, SAM uses phonemes, which are the basic units of speech. Here's an example of the phonetic spelling used with SAM:

MAY4 NEYM IHZ SAE4M

In ordinary English, this means, "My name is Sam." By using this phonetic method of spelling, SAM can be made to utter virtually any word in any language. The numbers used in the example above, along with a few other special characters, allow you to vary the stress or inflection of the speech. The number 1 indicates extreme stress (which you would use if you were to hear that you just won the lottery), while an 8 indicates an extreme drop, expressing disappointment or depression.

This is a lot more control than even the more expensive outboard units will give you, but we have only begun to see all the things SAM can do. SAM's voice

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can also be changed in several ways. Normally SAM speaks in a male voice, but by varying the pitch, everything from a deep bass voice to an alto is possible. You can even adjust the rate of speech for a southern drawl. The possibilities don't stop there, either. You have additional control over SAM's "throat" and "mouth." These will change the overall tonal quality of SAM's speech. All of these can be adjusted using the additional Basic commands made possible by the SAM Wedge.

Sam has a companion called Reciter (on the same disk with SAM). Reciter understands 450 of the most important rules of the English language. With Reciter loaded and activated, you can input your words and sentences in plain English, and Reciter will help SAM say them for you. It is far from perfect speech, but it does a more than adequate job.

There are some limitations when using SAM. Under normal conditions, SAM prefers to work in the dark and consequently blanks the screen every time he speaks. It is possible using one of SAM's additional commands to turn the screen back on. SAM also disables interrupts in order to keep his own voice intact. One Poke will re-enable the interrupts.

SAM has just a bit of trouble breathing, so he can only sustain speech for about two and one-half seconds without a break. This isn't really much of a limitation, though. After all, how often do you use a word such as "antidisestablishmentarianism"?

On the same disk with SAM and Reciter are some additional programs, used to demonstrate the power and versatility of SAM. In the Demo program, SAM sings the Star Spangled Banner and recites the Gettysburg Address and the famous soliloquy from Hamlet. A simple program called Guessnum (guess the number) suggests the type of interactive learning or game programs that can be created with SAM. A program called Sayit lets you experiment with SAM's different voices.

The documentation is quite good. There is a dictionary included that contains the phonetic spelling for many popular words. Though the compatibility of the SAM program with other software packages is not guaranteed, customer support is available. The disk is guaranteed for a period of 90 days. After that, there is a $5 replacement fee for a damaged disk, provided you are a registered SAM owner.

In the short time SAM has been with me, I have put him to work in several of my programs. Voice synthesis has obvious applications for those with vision impairments. I have a modified version of Totl Software's Totl.Text word processing program that speaks the words as you type them in.

I ran into some problems in trying to use SAM with a modem program. The problem appears to be that when an RS-232 channel is opened for communications, all variables are zeroed. The program works for the first few words, and then it seems that the string variable storage area gets confused. At this point SAM beeps at you indicating an error. By typing the error command, SAM will tell you what he didn't like about the string you fed him! With any luck, these problems can be overcome, and I'll be able to create a fully voiced modem program in the future. *(Tronix, 8295 South LaCienega Blvd., Inglewood, CA 90301. $59.95.)*

Jim Grubbs
Springfield, IL

Normally SAM speaks in a male voice, but everything from a deep bass to an alto is possible.

Mothership

Hostile Enemy Fighters Block Your Quest to Capture the Mothership

C

Three games in one! That's the most outstanding feature of Softsync's Mothership, an arcade-style offering for the Commodore 64.

In the first screen, gamers pilot a spacecraft through a trench, destroying enemy drones as they are launched from the Mothership, hovering motionless overhead. Similar to the celebrated Star Wars scene, this action-packed sequence takes place in the midst of the Zarway, a space corridor.

Eliminating twelve drones in a row, without the loss of a single fighter, advances space jockeys to the middle screen of this multi-screen game. Good luck!

Here, you must battle your way from the lowest to the highest level of the Mothership itself to usurp control of the hostile craft from its ill-intentioned owners. Starting at the lower right side, you must guide your on-screen surrogate across floors and into elevators in order to advance upward. Along the way, mutants attack and flying scanners make their rounds, attempting to dematerialize you. You're armed with nothing more than a one-shot-at-a-time laser weapon.

Left and right joystick maneuvers are used to move the on-screen figure accordingly. Pushing up on the stick allows you to jump the gaps in the floor. Though not fatal, falling through the holes forces a repeat of an earlier level. Not a nice predicament to face!

While you are in the elevator, the nasties can't get you, but neither can you dispose of them. Timing is of the essence here, since the elevators move slowly and the mutant meanies appear instantly. Sometimes they even pop up between your on-screen figure and the weapon in his outstretched hand. That's a certain curtain for one of the three game lives allotted for completion of this monumental task.

As if that's not enough, the control pod on the top level must be taken over before the fuel is depleted. Accomplishing this goal advances you to the final showdown. Controlling the Mothership

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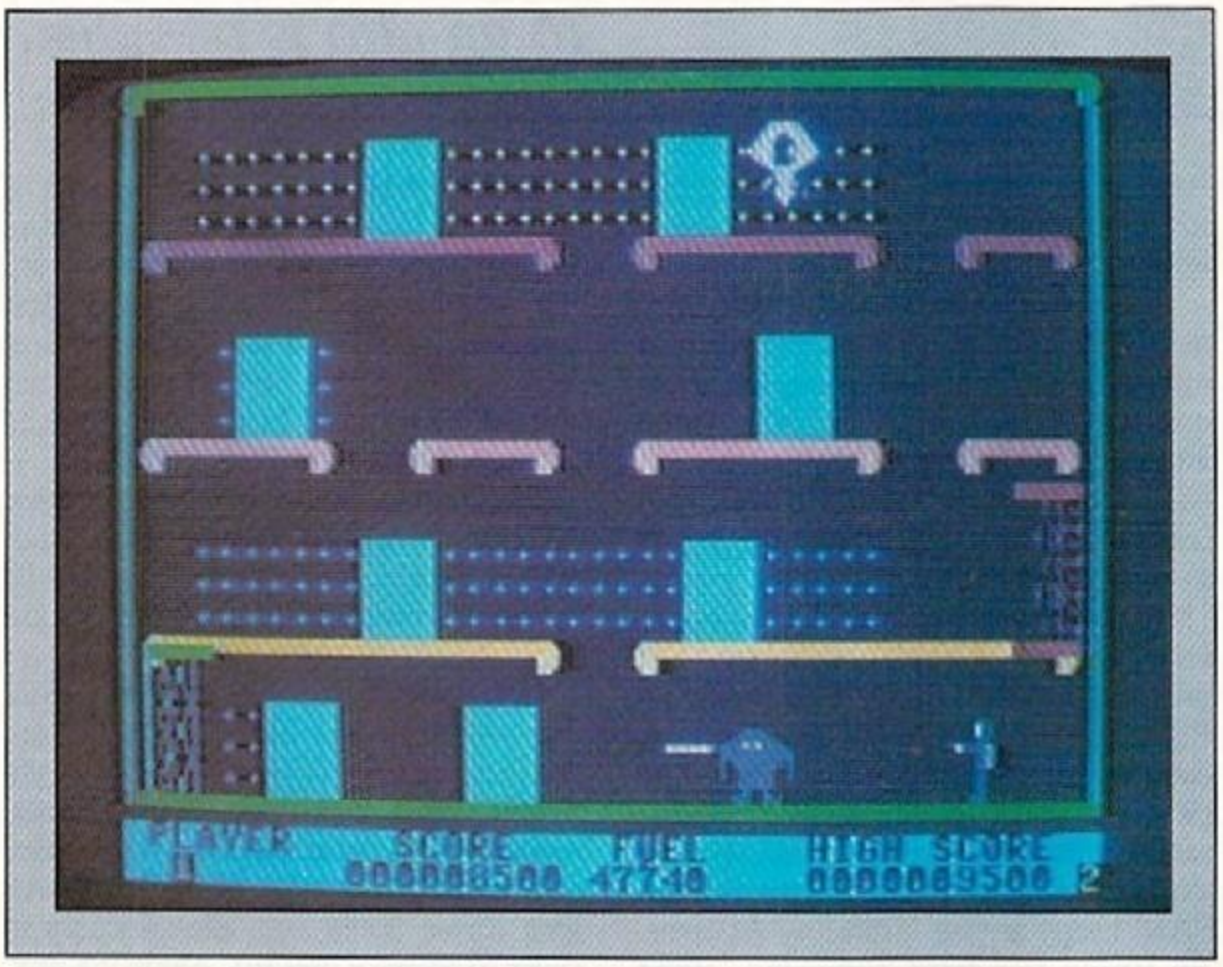
Although it contains some major rough spots, Mothership is an achievement of sorts.



now, you must guide it through the defenses of its home planet to destroy the power generators. Naturally, the defenses aren't all passive—you must beware of deadly energy torpedoes.

Amassing points along the way doesn't earn any special accolades or extra lives. Even beating the final screen does no more than reset the game to the initial screen, though at a faster pace.

The disk version loads in about 90 seconds, the cassette takes about ten minutes. If this seems like an eternity, that's because it is. The F1 key is used to select the one-player game, while F2 sets up the two-player version. The numerical keys (1, 2 and 3) are used to choose the difficulty levels: easy, medium or difficult. The game does have higher skill levels listed as 4 and 5, but these can only be attained through superior play.

The diversity of the three screens is tied together well by the plot. However, the execution is a bit off the mark.

The simulated 3-D effect of the Zarway Corridor just doesn't have enough oomph to it. The enemy drones increase in size as they approach, but your fighter can only move up, down, or left and right. This detracts from the attempted realism.

Also, the enemy fire sometimes destroys your fighter when it appears as though your fighter is out of the enemy's range. These are the major rough spots in the mechanics of the gameplay. The graphics are also rough, with limited detail.

Mothership is tough to play, even on the easy level—a quick-reacting joystick like the Amiga Powerstick helps a lot!

The sound effects are solid, but not outstanding. They certainly don't elevate the program.

Mothership is an achievement of sorts, since it provides three distinctive games in a tightly woven package. As noted before, the execution is not as good as the concept. Give it a test run before you buy. *(Softsync, Inc., 14 East 34th St., New York, NY 10016. $29.95.)*

Ted Salamone
Bridgeport, CT

Smithwriter

For Manipulating Text, This C-64 Word Processor Is Right at Home

C

Smithwriter (available in both disk and cassette versions) has one of the best instruction manuals for C-64 word processing I have yet seen. It is written in plain English and is understandable to the beginner without insulting the more knowledgeable user.

Furthermore, the manual is backed up by a foldout card that lists the various symbols and commands. Unfortunately, there isn't an alphabetized index for the manual or foldout card, which makes looking up certain specifics difficult.

Goodies

Every word processing program seems to have both goodies and gaps. Smithwriter starts its goodies with a Configuration mode, which allows you to decide on the colors of the screen display (to adjust to your particular monitor) and indicate your type of printer and method of storing text files (which is jargon for what you have just finished typing and want to save).

Unlike some other word processing programs for the C-64, Smithwriter lets you type in up to 17,000 characters before you have to print or store them. That gives you six pages of text, so you don't have to worry about overloading or running out of space. However, if you *do* get carried away and exceed the magic number of characters allowed, Smithwriter erases everything you've written. That ought to teach you to pay attention to the "FREE= ####" at the bottom of the text/edit screen. When it gets close to 0, store the text on disk or tape, erase it from the computer's memory and carry on.

As with the instruction manual, the prompts (instructions) on the screen are clear and easily found. They make storing, moving, editing, printing and all other manipulation of the text easy.

This program lets you adjust line length and tab settings, and provides a number of options for printing the text.

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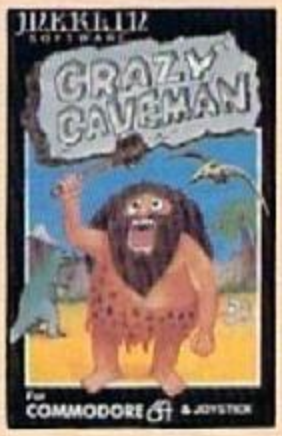

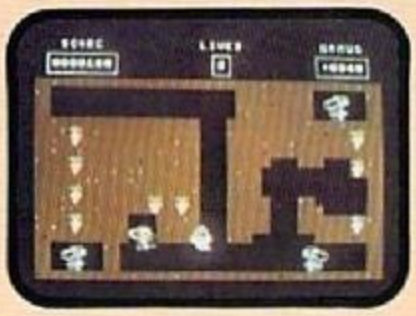

CRAZY CAVEMAN
(Merlin Software)
Journey back to prehistoric times. The first men are sharing the planet with weird and terrifying creatures. You are one of the hunters: ambushed by a sabre-toothed tiger and separated from your companions, you begin the hazardous trek home.
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Keep Smithwriter on your list of good C-64 word processors —at least for home use.

Among these printing options are centering, condensed print and doublestrike. Unfortunately, these options do not work on my daisywheel typewriter—not even the centering command. They don't work on my tiny printer either, but, with the line length set at 24, the little printer will handle the text in Smithwriter.

Badies

Now a few words involving word wrap (splitting words arbitrarily, or moving them down to the next line to keep them whole). To proofread and edit a document of any length, the words should either be complete or properly hyphenated. When a word is split improperly, it is difficult to proofread accurately, and Smithwriter splits words this way on every other screen line.

Smithwriter enables you to set the line length at 39, but you cannot reset anything typed at this length. This makes proofreading possible, but printed line lengths ridiculous. I haven't figured a way around this, although I have tried.

As mentioned above, the embedded printing commands are only for certain printers. Since there is no way to access the ASCII codes with this program, I cannot program my printer to use any of its more sophisticated functions, such as underlining, strikeover, degree symbols and the like. When I have a printer with these functions, I certainly want my word processing program to make them accessible.

Wrapping It Up

Thus, the lack of word wrap in half of the displayed lines, the lack of access to the ASCII codes for utilization of certain printer functions, the lack of any form of window to see what the finished document will look like when printed and some smaller details eliminate Smithwriter from the category of word processing programs for professional purposes.

However, its well-written instructions, the clarity and availability of the on-screen prompts, the holding of six pages of text in memory and some of the lesser goodies keep Smithwriter on the list of good word processing programs for the Commodore 64, at least for home use such as letter writing, filing and the like. *(Softsmith Corp., 2935 Whipple Road, Union City, CA 94587. $29.95.)*

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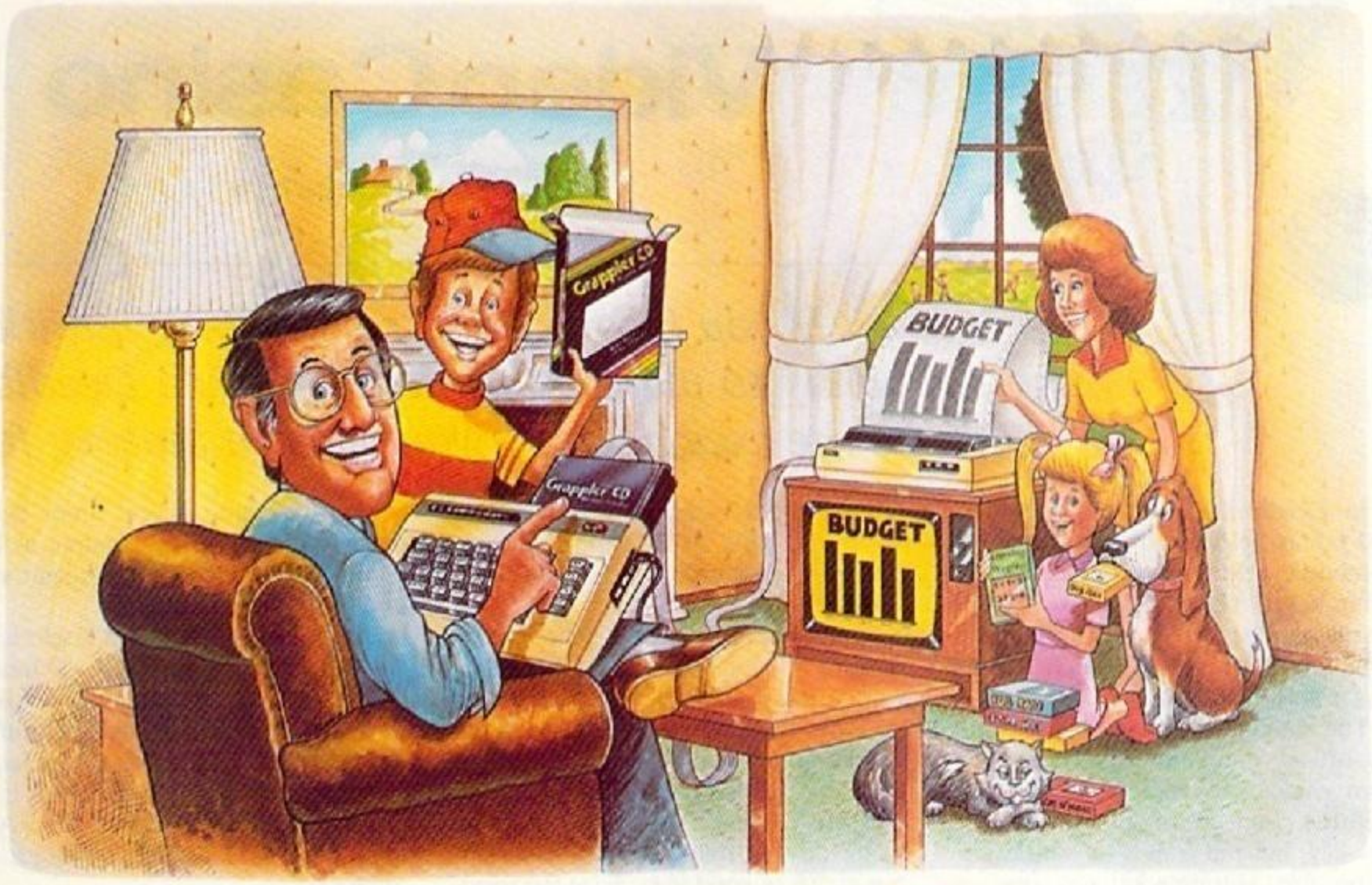

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Video Casino

By David D. Busch

If you have a lot of nerve, some intuition and the ability to make a fast decision, then Deadline might be the exciting game you've been looking for.

In Deadline, you must accumulate 500 points before your opponent. The computer selects a random number from 100 to 599, but you won't know which number. If your intuition or computer ESP gives you a clue, you'll be far ahead of the game.

The computer then will begin counting off the numbers from 1 to its random choice on the screen. You may stop the count at any time by pressing any key, but the goal is to wait as long as possible. Hitting a key too soon can be disastrous. Waiting too long is worse. The number could be 580 or 114.

Scoring is fairly simple. If the computer chose 365 and reaches that number before you've pressed a key, then 365 will be subtracted from your score.

Why not just press a key too soon and collect a modest number of points? Not so simple. The computer always *subtracts* the number of points it has yet to display from the number of points it has already displayed. So, if you press too soon, you might get a negative score.

For example, assume that the computer was counting to 500, and you pressed a key at 200. Three hundred points were left undisplayed, so 300 is subtracted from 200, leaving a negative 100. Therefore, 100 will be subtracted from your score.

If you had allowed the game to continue to 300 points, then only 200 points would remain undisplayed. That would net you 100 positive points. In other words, you must allow the count to continue to the halfway point (wherever that is!) to break even. After halfway, the points start rolling in. If you chicken out at 598 (a good idea, since the maximum is 599), then you'll only lose a maximum of 2 points and gain a whopping 596. Such occurrences will be rare, however, and it will probably take you a few turns before you reach the game-winning total of 500 points.

The Program

You might want to wait until you've played the game a few times before reading the rest of this column, as I reveal a few secrets that you might want to discover on your own.

The ceiling for each turn is selected in line 340 (line 300 in the VIC-20 listing). PT is equal to a random number from 1 to 499 plus 100. The smallest number chosen will be 101, and the largest 599. The game will be more fun if the players do not know this at first. After some play, they'll notice a pattern and catch on.

In fact, one of the most enjoyable things about Deadline is that discovering the ground rules and limits are part of the play. Early on, some players will hit a key very soon. The penalty points will show them the error of their ways. More cagey players will figure out a strategy that will let them take advantage of the odds.

RUN It Right

VIC-20
Commodore 64

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Display of the numbers is just a For...Next loop, from 1 to PT, using a sound routine at line 770 (line 740 in the VIC-20 listing). A GET A$ line pauses only if a key is pressed.

Waiting too long results in the gain, GA, becoming a minus value. Pressing a key causes the program to calculate the difference between high number reached and possible high, and awards points on that basis.

After each turn, if the variable, Player, was 1, it becomes 2, and vice versa, effectively bringing the next player on board. Several clever sound routines were added to this game to make it more fun.

As in recent months, we're offering suggestions on how you might change the rules of Deadline to add variety and excitement. How about adding a line that will produce a different upper or lower limit for each game played? In other words, program the computer to select numbers no lower than 200—or as low as 50! Or make it choose numbers that will be no higher than 600 or as high as 1000.

Hitting a key too soon can be disastrous, but waiting too long is worse.

Within each game, the limits should always remain the same. This will give the players an opportunity to try and guess what limits have been established for that game. However, the limits will change from playing to playing, so the game will always be new and interesting.

For another variation, have the computer choose the winning point total at random each game. Instead of fixing it at 500, allow the computer to change the winning total to 400 for some games, 800 for others. But don't tell the players what the goal is. That way, not only will they have to guess what number to stop at—but at how many more points they need to accumulate to win.

For hints on how to command the Commodore 64 or VIC-20 to choose a number in a given random range, examine line 340 (line 300 in the VIC-20 listing). R

Listing 1. Deadline program for the C-64.

```
10 REM ************
20 REM *{10 SPACEs}*
30 REM * DEADLINE *
40 REM *{10 SPACEs}*
50 REM ************
60 POKE 53281,1
70 VOLUME=54296
80 VCE=54273
90 POKE 54276,33
100 PRINT"{SHFT CLR}{2 CRSR DNs}"
110 PRINTTAB(12)"{CTRL 9}{CTRL 4}DEADLINE{CTRL 7}{2 CRS
    R DNs}"
120 PRINTTAB(8)"TWO PLAYERS WAIT"
130 PRINTTAB(8)"AS LONG AS THEY DARE"
140 PRINTTAB(8)"BEFORE PRESSING KEY."
150 PRINTTAB(8)"CLOSER YOU GET TO"
160 PRINTTAB(8)"THE DEADLINE, THE"
170 PRINTTAB(8)"MORE POINTS YOU GET."
180 PRINT"{3 CRSR DNs}";TAB(12)"{CTRL 9}{CTRL 3}HIT ANY
     KEY"
190 PRINTTAB(10)"{CTRL 9}FOR FIRST ROUND{CTRL 7}"
200 GET A$:IF A$="" GOTO 200
210 PLAYER=1
220 FOR N=1 TO 2
230 PRINT"{SHFT CLR}{2 CRSR DNs}"
240 PRINTTAB(8)"ENTER NAME OF"
250 PRINTTAB(8)"PLAYER #";N
260 INPUT PLAYER$(N)
270 NEXT N
280 PRINT"{SHFT CLR}"
290 PRINTTAB(8)"IT IS NOW"
300 PRINTTAB(8)PLAYER$(PLAYER);"'S TURN."
310 PRINT"{3 CRSR DNs}";TAB(12)"{CTRL 9}{CTRL 3}HIT ANY
     KEY"
320 PRINTTAB(10)"{CTRL 9}FOR NEXT ROUND{CTRL 7}"
330 GET A$:IF A$="" GOTO 330
340 PT=INT(RND(1)*500)+100
350 FOR N=1 TO PT
360 GOSUB 770
370 GET A$
380 IF A$<>"" GOTO 490
390 PRINTTAB(16)N
400 NEXT N
410 GOSUB 770
420 PRINT"{SHFT CLR}{2 CRSR DNs}"
430 PRINTTAB(8)"SORRY, SPORT. TIME{CRSR DN}"
440 PRINTTAB(8)"HAS RUN OUT.YOU LOSE{CRSR DN}"
450 PRINTTAB(8)PT;" POINTS.{2 CRSR DNs}"
460 GA=-PT
470 GOTO 590
480 GOTO 590
490 GOSUB 770
500 PRINT"{SHFT CLR}"
510 IF INT(PT/2)>N THEN PRINTTAB(8)"SORRY, SPORT.{CRSR
    DN}"
520 PRINTTAB(8)"YOU GOT UP TO{CRSR DN}"
530 PRINTTAB(8)N;" AND COULD{CRSR DN}"
540 PRINTTAB(8)"HAVE GONE AS FAR AS{CRSR DN}"
550 PRINTTAB(8)PT;". YOU GET SOME{CRSR DN}"
560 DF=PT-N
570 GA=N-DF
580 PRINTTAB(8)GA;"POINTS.{CRSR DN}"
590 PP(PLAYER)=PP(PLAYER)+GA
600 IF PP(PLAYER)>499 GOTO 680
610 PRINTTAB(8)"YOUR SCORE:";PP(PLAYER)
620 PRINT"{3 CRSR DNs}";TAB(12)"{CTRL 9}{CTRL 3}HIT ANY
     KEY"
630 PRINTTAB(11)"{CTRL 9}FOR NEXT ROUND{CTRL 7}"
640 GET A$:IF A$="" GOTO 640
650 IF PLAYER=1 THEN PLAYER=2:GOTO 280
660 PLAYER=1
```

(continued on page 122)

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Computer Tutor

By Christine Adamec

With software manufacturers scrambling to cash in on the burgeoning educational field, RUN *introduces a bimonthly series that takes a close look at some of the better-known commercially available educational programs—suitable for learning at home or at school. Welcome to the Computer Tutor.*

Relax for a moment and travel back in your mind...to when you were about seven years old. Okay, got it? The scenario is that you're learning some basic math. Now, as you successfully added 3+3, did you get brilliant flashing colors, rousing music, pretty pictures or points as your reward for the right answer?

Of course not! It was 3+3=6, and that was it. Ho hum. And whether you caught on right away, or it took you awhile to figure it out, you could have been turned off by this boring subject for years.

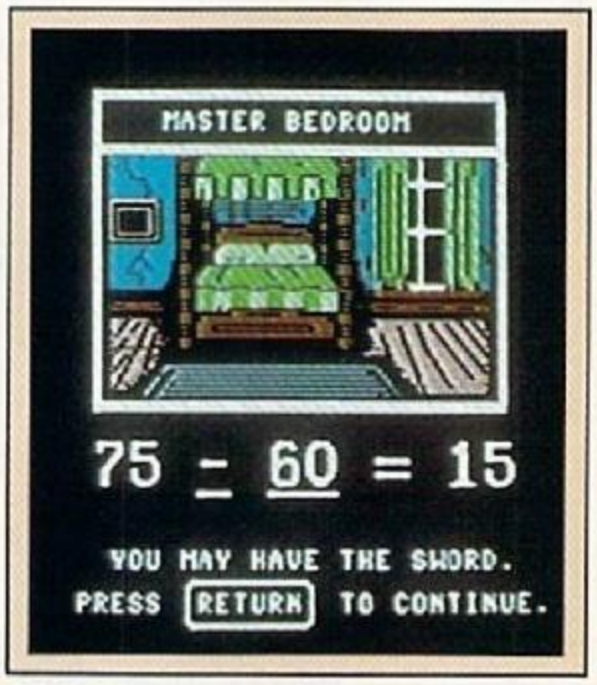
But now your children can learn math and have fun doing it. As their knowledge grows, so too may their desire to know more.

Today, highly interactive and creative children's math programs are available for your C-64. These programs enable your kids to proceed at their own pace, rather than at the "lowest common denominator" of understanding in a classroom. Even if your children are highly motivated and/or have inherited your math-whiz genes, they could still profit from these educational programs.

This month, you'll learn about four exciting and outstanding math programs—Tri-Math, Piece of Cake, Math Blaster and Space Math. They're all programs for elementary-school children, and they cover the basics of learning and reinforcing addition, subtraction, multiplication and division. (Math Blaster also includes decimals and percents.)

Tri-Math

Tri-Math is a three-part program from Human Engineered Software (150 North Hill Drive, Brisbane, CA 94005; $34.95, disk). This program gives you



Tri-Math is an adventure game and educational program in one.

three options: Math Mansion, Alien Invaders or Digitosaurus.

Math Mansion has outstanding graphics, depicting a scary old mansion and the rooms inside it (complete with flickering candles, flying bats and so on). It's a children's adventure game—you've entered the house and now must find your way out.

You're given a choice of rooms to enter in your search for the exit, but before meandering from, say, the nursery to the ballroom, you must first answer a fill-in-the-blanks math problem. For example, 5 =30. You could answer 5×6=30 or 5+25=30; both are right.

As you move through the rooms, you're given the opportunities to pick up a sledgehammer, rope and other objects you'll need to break through the brick wall, swing across the pit and so on. If you answer correctly, you get to move to the next room. If your answer is incorrect, you stay where you are for the moment. (You don't die; it'll just take more turns to get out of the house.)

The game of Alien Invaders tests your math skills by pitting you against the alien, who will try to find the answer before you do. You select from four to 12 problems and whether you want addition, subtraction and so on; then the game begins.

You're given a spaceship with wings displayed in a circular pattern around a problem. On each wing is an answer. Using the <and> keys on your C-64 keyboard, you move the little blue dot to the correct answer, then press the space bar. I like the dramatic sound as the wing fills up with color when you give the correct answer. (And, of course, if your answer is wrong, the alien wins. We earthlings must prevail over alien "visitors"!)

In the game Digitosaurus, you're presented with three problems (without the answers), and it's your job to move the dinosaur to the problem with the largest answer. You then must tell the computer what the answer actually is. After you've answered, the dinosaur moves across the screen, swishing his tail against the wrong answers, which disappear in an array of stars. (This is ac-

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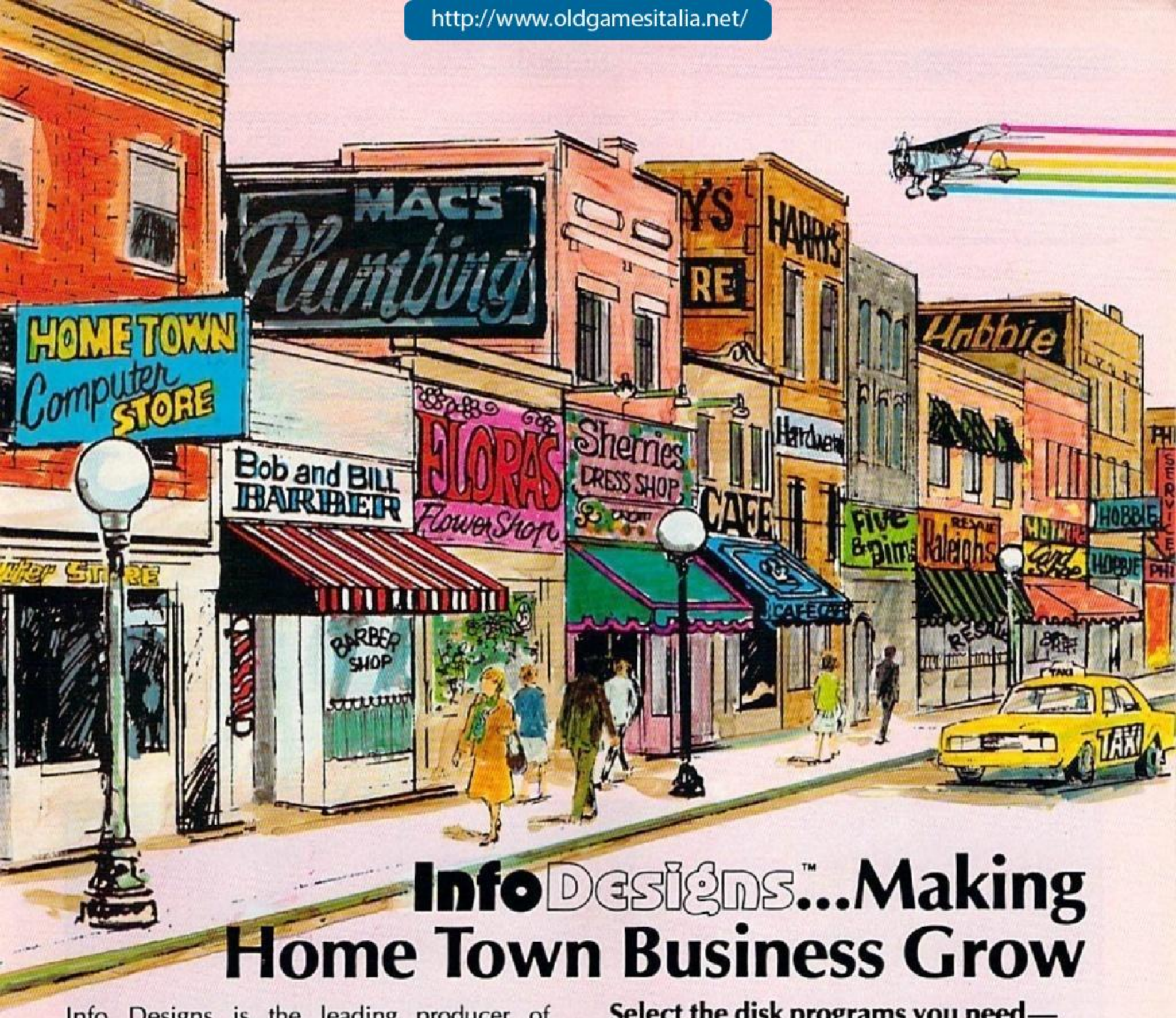

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companied by simple music.) This game's a little slow, but reassuringly so to many children.

Math Blaster

Math Blaster, from Davidson & Associates (6069 Groveoak Place #12, Rancho Palos Verdes, CA 90274; $49.95, disk), is a comprehensive two-disk program created and extensively field-tested by professional educators. It provides five levels of difficulty for each area: subtraction, addition, decimals, multiplication and division. You must select one of four options available to you.

Do you want to start with Look and Learn, which shows you a problem and the answers? Or do you want Build Your Skill, wherein you give the answer. Challenge Yourself gives you only part of the problem, and you supply the missing part. (Plenty of reinforcement is provided, with such messages as "Way to Go!" and "Congratulations!" given in response to correct answers.)

Then there's the circus-like Math Blaster. I showed this game to a group of second- and third-graders, and they loved it!

You're given a problem, and four different answers are displayed in boxes on the top of the screen. Using either the keyboard or your joystick, you move your man under the right answer and quickly press the Z key—your man is propelled through a cannon to the answer! (And of course you'll gain points for that.) A seal bouncing a ball on his nose keeps time and you must move your man before the balloon bursts, signifying that your time has run out.

Seven-year-old Jamie didn't want to quit. "Just one more game," he assured me repeatedly, until his teacher came over, stood next to him and gave him a "look." Sigh, then detachment from the keyboard.

I highly recommend Math Blaster. When you answer incorrectly, you're merely told, "Try again." No raspberry noises, no Armageddon on the screen.

The manual is well-documented, explaining every phase of the program thoroughly. I liked, too, its feature that allows you to add in your own math problems later, using the detailed instructions provided in the manual.

The only negative aspect of Math Blaster is its price, which is a little steep, but if you can afford Math Blaster, I strongly recommend it.

Piece of Cake

Piece of Cake, from Counterpoint Software (4005 W 65th St., Minneapolis, MN 55435; $29.95, disk), is a colorful and creative approach to learning and reinforcing math skills. It's composed of five games that are centered around the theme of bakers and cakes. The picture menu rotates continuously, and you press any key to start the game you've chosen.

Second-grader Jessica most enjoyed The Bakery, a game in which you're

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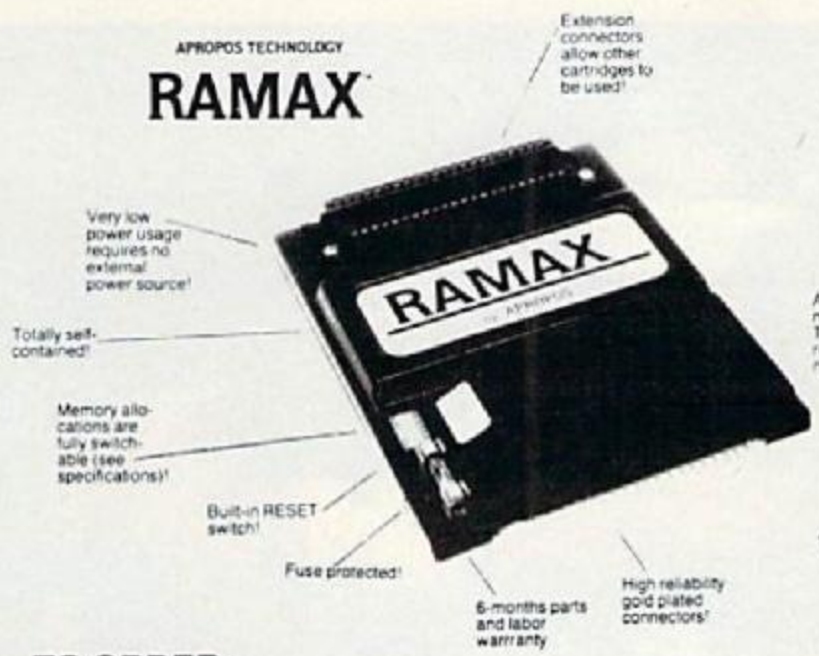
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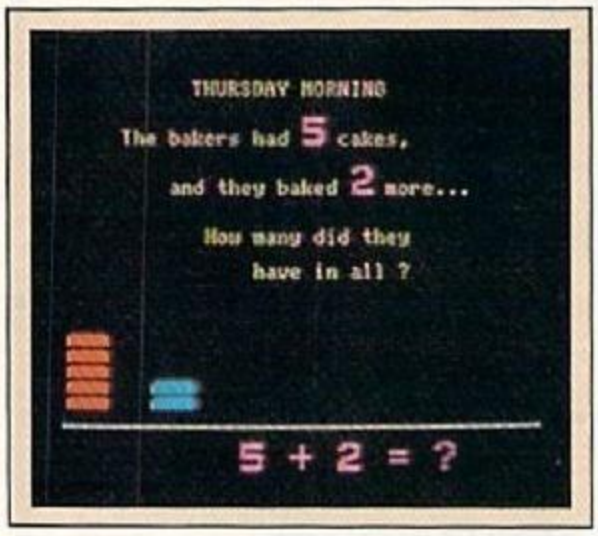


This game's a Piece of Cake, from Counterpoint Software.

given a little story problem with pictures. For example: "On Monday the bakers had 3 cakes, and they baked 3 more. How many did they have in all?" If you type in 6, the blue cakes on the right slide (to the accompaniment of music) on top of the green ones, which then also turn blue. If you answer incorrectly, then the program gives you a few hints—it wiggles the three cakes, shows you the problem numerically (3 + 3 =) and so on. And if you still can't respond correctly, you'll be given the right answer.

In the game Catch-a-Cake, the cake is falling and you must quickly answer a problem before it self-destructs. Answer correctly and the computer displays "Good, you caught it!" Answer incorrectly and the cake goes splat, and you receive an "Oops, too bad" message.

Catch-a-Cake can be played by up to four players, each striving to build up points—good for the old competitive spirit. But you can get negative points, too, and the eight-year-olds to whom I showed the program were confused, not having learned the concept of negative numbers.

I liked the positive reinforcement of sound and messages in this package. Also, you may select your level of difficulty, from beginner to super math. (Here's a super-math problem: 67 × 68.)

Piece of Cake is a good value.

Space Math

This math program from Entech (10733 Chiquita, Studio City, CA 91604; $39.95, disk) gives you reinforcement galore—the computer actually *talks* to you, you get written messages ("You Did It!"), music, graphics and a blastoff into outer space!

After selecting what you want to work on (adding, subtracting and so on), your skill level (from 1–3) and your speed (from 1–6), you're ready to begin. You'll see either a skating chicken, a little hat with feet or a cute elfin-gremlin creature.

Answer the displayed problem correctly, and the chicken skates, the hat moves and so on. Every other right answer earns you an out-loud "Hey hey, that's right!" or "I'm Super-Chicken!" and so on. (Each skill level has its own message.) Yes, I mean it, the computer actually talks to you, not in a scary robot-like monotone, but with the enthusiastic voice of a kid! (I really liked that, and so did my children.)

Then, if you make it in time to the right side of the screen with all the right answers (while the counter on the screen displays the remaining time), you're rewarded with another verbal message. I liked "Who says chickens can't fly!" and "Let's party!"

After that, your chicken blasts off and skates and dances to a disco melody in three-part harmony, amidst a beautiful otherworldly graphic. (The hat and elf have their own different songs and scenes.)

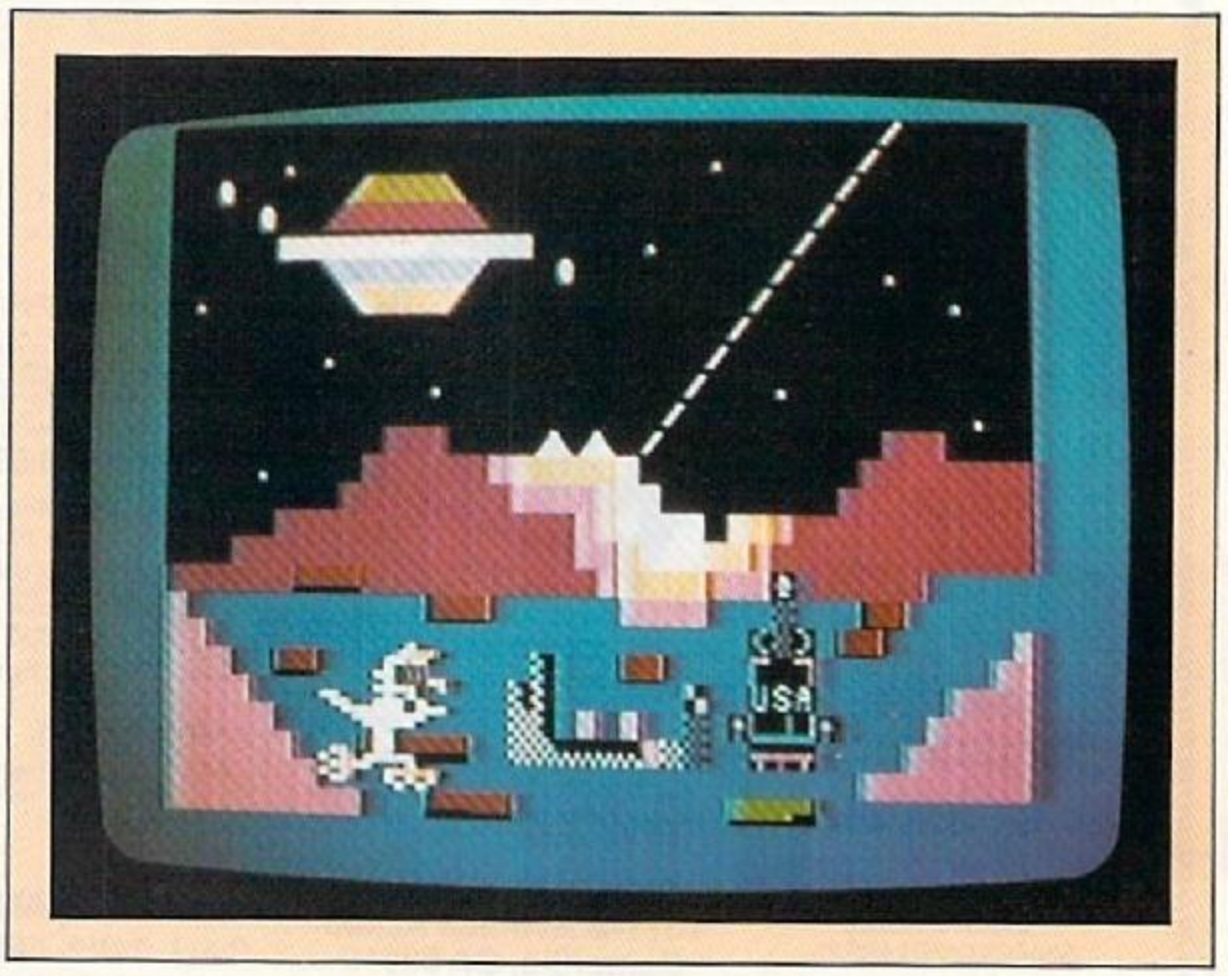
If you answer the problem incorrectly, the computer tells you you're wrong. Answer incorrectly again, and the computer says, for instance, "Try 10," or whatever the answer is.

One caution: If you're an adult adding say, 27 + 9, you might tend to type in 36 with the 3 first and the 6 second. But a child enters the answer from right to left and would type in 6 first and then 3. Knowing this, the creators of Space Math have programmed the numbers in such problems to go from right to left.

This program is highly entertaining and a good learning experience. It would be useful for your children at home as well as for kids in the classroom.

When it comes to math, is "no pain, no gain" still the bottom line? Not anymore. Our kids can learn their basic math concepts using these outstanding computer math games *and* have a great time doing it. Sure, you don't *need* the color, music and fanfare to learn how to add and subtract, but wouldn't *you* have preferred it? I would have! R

Christine Adamec (1921 Ohio St. NE, Palm Bay, FL 32907) is a professional writer, with articles in McCall's, Graduating Engineer, In Business *and* RUN *to her credit. As the mother of two children, ages five and six—who frequently serve as her guinea pigs for testing—she has become particularly intrigued with the subject of children's software. She eagerly invites readers to send in their comments on this column's content.*



Super-Chicken is a helpful instructor in this Space Math program from Entech.

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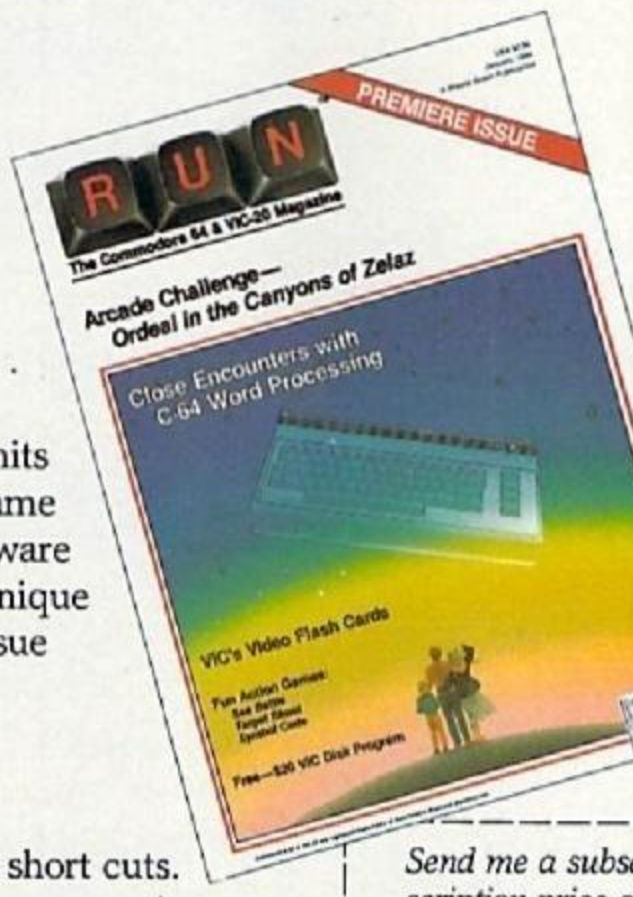

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Battleship War

By Keith Meade

This battleship game challenges you on two fronts: Defend your fleet from enemy attack and learn this programmer's memory management tips to take advantage of the C-64's special graphics features.

You are in command of a battleship. Submarines silently move under the area you defend, seeking to attack your fleet's most vulnerable slips. Enemy planes pass overhead in a continuous stream.

You sit at the controls with clenched jaw and beaded brow. Blazing cannon fire and well-placed depth charges extract a heavy toll. For three tense minutes you batter the opposition hordes, then emerge in exultant victory, sporting a new high score.

Battleship War, an arcade-style game for the Commodore 64, begins with an instruction display that describes user controls and target point values. You must, as in any good shoot-'em-up, blast as many objects as possible—the smaller the targets the higher the point value. The submarines can be elusive, but if you watch them too closely, the airplanes will slip past you.

Playing for high score is definitely the way to go with Battleship War. The champion of this household is my wife; as of this writing, you'll need 2330 points to match her best score.

When typing the program, omit all remarks. Lines that end with 97–99 and contain asterisks may also be skipped. Notice that I substituted decimal points (periods) for zeroes, thus somewhat speeding up the program.

The game display for Battleship War is composed entirely of redefined characters. When you use custom character sets and the Commodore's

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other graphics features, memory management becomes a problem. Understanding where to store graphics data and getting the 64 to use it can be difficult. I'll discuss this problem and how I dealt with it in Battleship War.

I will conclude with a simple routine that lets you easily move screen RAM and open up a large area of free memory for sprites, character sets, high resolution displays and other features.

Defining the Problem

You should keep in mind that the C-64 features two separate systems sharing memory space—the video chip (VIC) and the Basic language. The VIC chip (not to be confused with the VIC computer) handles all data and operations that relate in any way to the video display. The VIC, however, has a limitation for which you must allow—the chip can access only 16K of memory. I will refer to this memory as the VIC video bank.

Within this bank all data related to the video display must reside. Within the VIC video bank is an area I call screen memory, 1K of RAM that contains data for the standard text display. You will often see screen memory referred to as the video matrix or character pointer memory.

(Be sure at this point that you understand the concept of the 16K VIC video bank. Do not confuse it with the screen memory, which is only a portion of the video bank.)

With 64K of total memory, there are poten-

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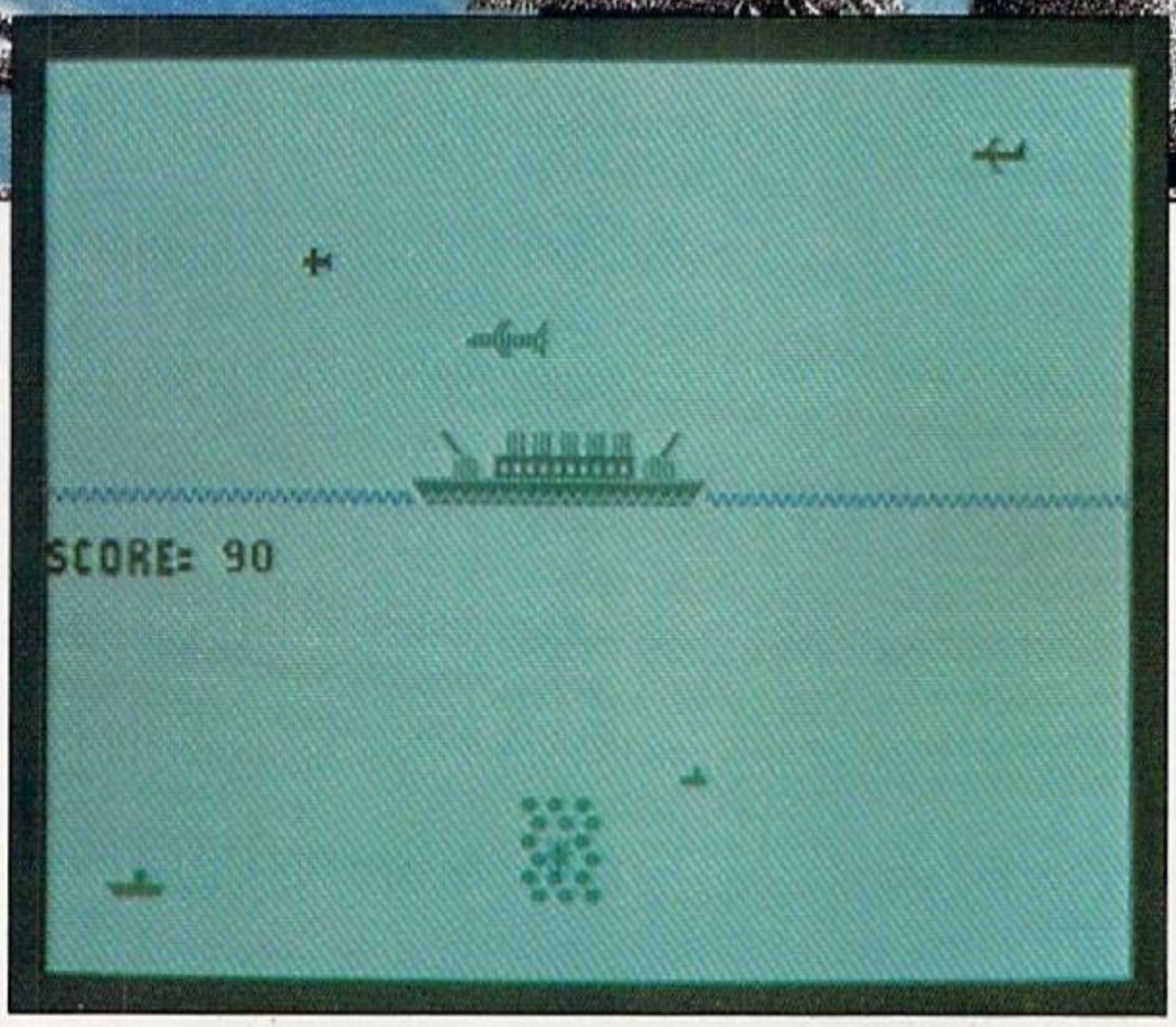

Listing of Battleship War program for the C-64.

```
10 POKE55,0:POKE56,128:CLR:REM{2 SPACEs}MOVE TOP OF MEM
   ORY DOWN TO 32768
20 GOTO5000
97 *
98 *{5 SPACEs}MAIN GAME LOOP
99 *
100 TI$="000000"
110 GETIN$:IFIN$=""GOTO150
120 IFIN$="{CRSR DN}"THENGOSUB2200
130 IFIN$="{CRSR RT}"THENGOSUB2400
140 IFIN$=" "THENDC=1
150 R=FNE(.):ONRGOSUB1000,1100,1200,1300,1400,1500,1000
    ,1300:IFDCTHENGOSUB2000
160 IFTI<TLIMGOTO110
170 GOTO7000
997 *
998 *{4 SPACEs}SMALL SUB
999 *
1000 POKEHOM+X(1)+SW*Y(1),BL:X(1)=X(1)+FND(.):IFX(1)<SW
     GOTO1020
1010 X(1)=1:Y(1)=FNB(.):IFY(1)=Y(2)ORY(1)=Y(3)GOTO1010
1020 POKEHOM+X(1)+SW*Y(1),34:RETURN
```

More

tially four VIC banks. Normally, the VIC chip is accessing the first bank. It sees the memory from addresses 0 to 16384. A look at a memory map reveals that this is a busy area. The only large chunk of free memory is within the space used by Basic, but unless you really know what's going on, only use Basic memory for a Basic program.

So, the major memory management problem is this: There is not sufficient available space to allow use of the 64's special graphics features. In the first VIC video bank, the bulk of unused memory is reserved by the Basic system for Basic programs. As it turns out, both Basic and the VIC chip are willing to compromise. The Basic space can be trimmed on either end. The VIC chip can look at any of the four 16K video-bank locations.

The simplest solution would seem to be moving back the beginning of Basic's program area. Basic programs normally start at address 2048. The following sequence would free up 4K bytes.

```
POKE 6144,0:POKE 44,24:NEW
```

Basic requires that the first byte in its program area be zero, so zero is the first Poke. The second Poke sets back the beginning-of-Basic pointer. The New command causes the program area to be straightened out within its new boundaries.

I've seen this method successfully used many times, but there's an obvious drawback. A program can't reserve memory for itself; there must be a separate

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Listing continued.

```
1Ø97 *
1Ø98 *{3 SPACEs}MED SUB
1Ø99 *
11ØØ A=HOM+X(2)+SW*Y(2):POKEA,BL:POKEA-1,BL:X(2)=X(2)+F
     NA(.):IFX(2)<SWGOTO112Ø
111Ø X(2)=2:Y(2)=FNB(.):IFY(2)=Y(1)ORY(2)=Y(3)GOTO111Ø
112Ø A=HOM+X(2)+SW*Y(2):POKEA,36:POKEA-1,35:RETURN
1197 *
1198 *{3 SPACEs}LARGE SUB
1199 *
12ØØ A=HOM+X(3)+SW*Y(3):FORI=A-2TOA:POKEI,BL:NEXT
121Ø X(3)=X(3)+FNA(.):IFX(3)<SWGOTO123Ø
122Ø X(3)=3:Y(3)=FNB(.):IFY(3)=Y(1)ORY(3)=Y(2)GOTO122Ø
123Ø A=HOM+X(3)+SW*Y(3):POKEA,39:POKEA-1,38:POKEA-2,37:
     RETURN
1297 *
1298 *{3 SPACEs}SMALL PLANE
1299 *
13ØØ POKEHOM+X(4)+SW*Y(4),BL:X(4)=X(4)-FNA(.):IFX(4)>.G
     OTO132Ø
131Ø X(4)=SW:Y(4)=FNC(.):IFY(4)=Y(5)ORY(4)=Y(6)GOTO131Ø
132Ø POKEHOM+X(4)+SW*Y(4),22:RETURN
1397 *
1398 *{3 SPACEs}MED PLANE
1399 *
14ØØ A=HOM+X(5)+SW*Y(5):POKEA,BL:POKEA+1,BL:X(5)=X(5)-F
     ND(.):IFX(5)>.GOTO142Ø
141Ø X(5)=39:Y(5)=FNC(.):IFY(5)=Y(4)ORY(5)=Y(6)GOTO141Ø
142Ø A=HOM+X(5)+SW*Y(5):POKEA,23:POKEA+1,24:RETURN
1497 *
1498 *{3 SPACEs}LARGE PLANE
1499 *
15ØØ A=HOM+X(6)+SW*Y(6):FORI=ATOA+2:POKEI,BL:NEXT
151Ø X(6)=X(6)-FNA(.):IFX(6)>.GOTO153Ø
152Ø X(6)=38:Y(6)=FNC(.):IFY(6)=Y(4)ORY(6)=Y(5)GOTO152Ø
153Ø A=HOM+X(6)+SW*Y(6):POKEA,25:POKEA+1,26:POKEA+2,27:
     RETURN
1997 *
1998 *{3 SPACEs}DEPTH CHARGE
1999 *
2ØØØ POKEFQ,38:POKEWV,TRI:PK%=PEEK(D):IFPK%<>BLANDPK%<>
     63GOTO2Ø3Ø
2Ø1Ø POKED,BL:D=D+SW:IFD>33767GOTO2Ø4Ø
2Ø2Ø PK%=PEEK(D):IFPK%=BLTHENPOKED,63:POKEWV,.:RETURN
2Ø3Ø C=D:GOSUB3ØØØ
2Ø4Ø D=33266:DC=.:POKEWV,.:RETURN
2197 *
2198 *{3 SPACEs}LEFT GUN
2199 *
22ØØ POKEFQ,1Ø:POKEWV,NOI:POKE33141,42:FORI=1TO1Ø:NEXT:
     C=.:POKEWV,.
221Ø FORI=331ØØTO32813STEP-41:POKEI+41,BL:PK%=PEEK(I):I
     FPK%=BLTHENPOKEI,4Ø:NEXT
222Ø IFPK%<>BLTHENC=I:I=32772:NEXT
223Ø IFCTHENGOSUB3ØØØ:RETURN
224Ø POKE32813,BL:RETURN
2397 *
2398 *{3 SPACEs}RIGHT GUN
2399 *
24ØØ POKEFQ,9:POKEWV,NOI:POKE33151,42:FORI=1TO1Ø:NEXT:C
     =.:POKEWV,.
241Ø FORI=33112TO32839STEP-39:POKEI+39,BL:PK%=PEEK(I):I
     FPK%=BLTHENPOKEI,41:NEXT
242Ø IFPK%<>BLTHENC=I:I=328ØØ:NEXT
243Ø IFCTHENGOSUB3ØØØ:RETURN
244Ø POKE32839,BL:RETURN
2997 *
2998 *{3 SPACEs}PLANE OR SUB HIT
2999 *
3ØØØ T=PK%:EX=62+(T<28):GOSUB35ØØ:TG=6:IFT=23ORT=24THEN
     TG=5:GOTO3Ø5Ø
```

(continued on p. 44)

set-up program or you must manually type in the configuration sequence. As long as there are alternatives, this technique should be unacceptable.

The beginning of the Basic program area actually contains the first lines of the Basic program itself. It's certainly understandable that we can't cut off that chunk of memory without destroying our program. So what about the other end of the Basic area?

The very top of Basic memory is used to store the values of variables (specifically, string variables). Stealing from here is going to zap the variables, but notice that the program itself will survive.

```
POKE 55,0:POKE 56,128:CLR
```

The Poke commands set the top-of-Basic pointer down 8K bytes. The CLR command forces Basic to rebuild its variable system at the new, lower location. After execution of this command, all string variables are null and all numerics are equal to zero.

Clearly, the drawback to this method is manageable and, as you will see, I recommend going with it. The secret is to reserve the memory before you declare or use any variables. To be safe, devote the first line of your programs to the function of clearing this space, if needed.

The Basic command sequence in the last paragraph sets the top limit of Basic at address 32768. Remember the VIC video banks? Well, the third bank begins at address 32768. Perfect!

```
POKE 56576,5
```

Believe it or not, this instructs the VIC chip to take all data from the third video bank. So, while you've lost 8K of Basic RAM (I've never written a program anywhere near 30K bytes long), you've gained free and clear memory for use of custom graphics.

You Can Bank on It

Unfortunately, the actual structure of the new video bank is complicated, but bear with me. You don't need to understand it at all if you're willing to abide by the rules and address boundaries I'm presenting.

From address 32768 to 36863 is a 4K chunk that can be used normally in any way you see fit.

Addresses 36864 to 40959 are the VIC chip's 4K "blind spot" in this video bank. The VIC ignores the RAM in this range and, instead, sees the character set ROM, which contains the definitions for the two standard Commodore character sets. Peeks and Pokes in the Basic program will see the RAM. You

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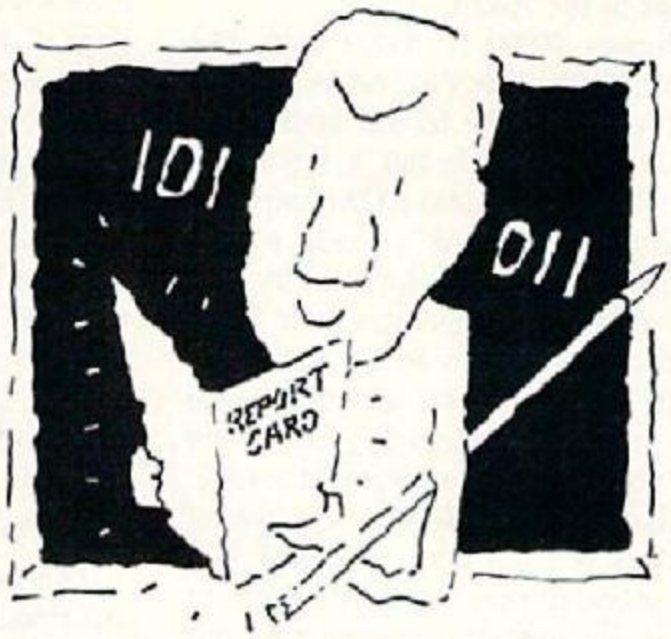

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could use this to store data or machine language in the RAM.

Addresses 40960 to 49151 look like 8K of RAM to the VIC video chip. A Basic program Poke to this area stores values in that RAM, but a Peek sees data in the Basic system ROM chip! It's confusing, but this is actually a very large and useful stretch of memory.

Just remember that you can Poke data in, but you can never Peek that data. (It's probably not an appropriate region for screen memory, but when would you ever need to Peek at a redefined character set?) Sprites, too, would oftentimes be fine here. Machine language programmers would be able to examine this memory by switching out the Basic ROM, but that's not possible in a Basic routine.

Screen memory, as you recall, is the 1K containing the text screen data. You may define screen memory as being any one of the 16–1K areas within the video bank. A character set is 2K in length, and any of the 8–2K regions of the video bank may be designated as containing the character set.

In Battleship War, I used variables to hold these location values. SCRAM could have a value of 0–15. SCRAM = 0 means that screen memory resides in the first 1K of the VIC video bank (thus, beginning at 32768). CHSET (value equals 0–14, even) specifies which 2K area holds the character set. Odd values of CHSET simply have the same effect as the next even number below.

The VIC chip contains a single register that sets the locations of screen memory and the character set. The following command will work for all meaningful values of SCRAM and CHSET.

```
POKE 53272,16*SCRAM+CHSET
```

The Basic system must be separately informed of the location of screen memory so that it can properly handle screen input and output. The following command will perform this.

```
POKE 648,128+4*SCRAM
```

Graphics Routines

Investigation of other graphics features should reveal how they fit into this memory configuration. Observe in the program Battleship War how the system has been specifically implemented.

Below are the routines from Battleship War that could be used in any program to relocate the video bank and open up space for your special graphics data.

```
10 POKE 55,0:POKE 56,128:CLR
```
(Remember, it is best to have this be the first program line.)

```
10000 IF SCRAM<0 OR SCRAM>15 THEN
      PRINT"SCREEN RAM ERROR":STOP
10010 IF CHSET<0 OR CHSET>15 THEN
      CHSET=4
10020 POKE 56576,5
10030 POKE 53272,16*SCRAM+CHSET
10040 POKE 648,128+4*SCRAM
10050 RETURN

10100 POKE 56576,7
10110 POKE 53272,20
10120 POKE 648,4
10130 RETURN
```

Save these program lines and use them. They'll make your life a lot easier, believe me.

To rearrange the video, set SCRAM equal to 0–15, CHSET equal to 0–14 (even) and GOSUB 10000. The new location of screen memory will be 32768 + 1024*SCRAM. The VIC chip will expect to see the character set at 32768 + 1024*CHSET. CHSET = 4 will point the VIC to the standard character set (6 for upper/lowercase).

Sprites or other graphics features may easily be used by keeping the previously described VIC memory bank structure in mind. Remember, in particular, that the sprite image pointers are part of the screen memory and move with it.

To restore the usual configuration, enter GOSUB 10100. The default screen memory area at location 1024 is not disturbed by any of this activity. Toggling between the two subroutines offers a simple method of page flipping, with which you might wish to experiment.

I'll conclude this discussion with a little demo program to get you thinking. Type in these lines along with the above routines (don't forget line 10).

Before you run the program, notice that the Print statements are only executed once.

```
100 PRINT "(clear screen)"
110 PRINT "THIS IS THE OLD SCREEN."
120 SCRAM=0:CHSET=4:GOSUB 10000
130 PRINT "(clear screen)"
140 PRINT "HERE IS THE NEW SCREEN!"
150 FOR D=1 TO 1000:NEXT
160 GOSUB 10100
170 FOR D=1 TO 1000:NEXT
180 GOSUB 10000
190 GET A$:IF A$=" " GOTO 150
200 GOSUB 10100:END
```

Press any key to end the program. I hope you can put these routines to good use. Don't forget to try Battleship War. R

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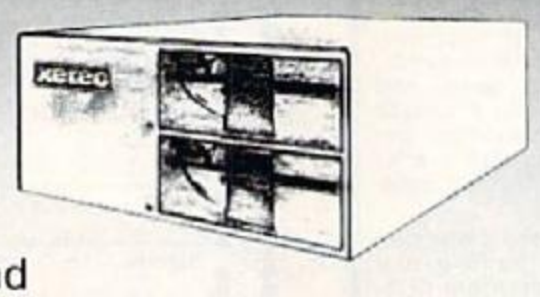

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(from p. 40)

```
3Ø1Ø IFT>36ANDT<4ØTHENTG=3:GOTO3Ø5Ø
3Ø2Ø IFT=35ORT=36THENTG=2:GOTO3Ø5Ø
3Ø3Ø IFT=22THENTG=4
3Ø4Ø IFT=34THENTG=1
3Ø5Ø TPT=TPT+PT(TG):PRINT"{CRSR UP}";SL$;TPT;"{5 SPACEs
     }":X(TG)=-SW*(TG<4):RETURN
3497 *
3498 *{3 SPACEs}EXPLOSION
3499 *
35ØØ POKEWV,SAW:IFEX=62THENPOKEWV,TRI
351Ø FORI=C-2TOC+2:POKEI,BL:NEXT:POKEC,42
352Ø FORI=C-SWTOC+SWSTEPSW:FORI2=-1TO1:A=I+I2:IFPEEK(A)
     =BLTHENPOKEA,EX
353Ø POKEFQ,2Ø-1Ø*I2:NEXTI2,I:POKEWV,.
354Ø FORI=C-SWTOC+SWSTEPSW:FORI2=-1TO1:A=I+I2:IFPEEK(A)
     =EXTHENPOKEA,BL
355Ø NEXTI2,I:POKEC,BL:RETURN
4997 *
4998 *{3 SPACEs}INITIALIZE
4999 *
5ØØØ PRINT "{SHFT CLR}{2 CRSR DNs}INITIALIZING....."
5Ø1Ø POKE 5328Ø,11:POKE 53281,1:REM{2 SPACEs}SET SCREEN
      COLORS
5Ø15 REM{2 SPACEs}SET SOUND VOICE #1
5Ø2Ø POKE 54296,15:REM{2 SPACEs}VOLUME
5Ø3Ø POKE 54277,Ø:REM{2 SPACEs}ATTACK-DECAY
5Ø4Ø POKE 54278,24Ø:REM{2 SPACEs}SUSTAIN RELEASE
5Ø5Ø POKE 54272,1ØØ:REM{2 SPACEs}LO FREQ.
5Ø6Ø FQ=54273:REM{2 SPACEs}HI FREQ. REGISTER
5Ø7Ø WV=54276:REM{2 SPACEs}WAVE FORM REGISTER
5Ø8Ø NOI=129:SAW=33:TRI=17:REM{2 SPACEs}WAVE FORM VALUE
     S
5Ø9Ø HOM=32727:D=33266:REM{2 SPACEs}SCREEN LOCATIONS
51ØØ TLIM=1Ø8ØØ:REM{2 SPACEs}TIME LIMIT (JIFFIES)
511Ø BL=32:SW=4Ø:REM{2 SPACEs}VALUE TO POKE BLANK, SCRE
     EN WIDTH
5115 REM{2 SPACEs}SET RANDOM VALUE FUNCTIONS
512Ø DEF FN A(R)=INT(RND(R)*3+1)
513Ø DEF FN B(R)=INT(RND(R)*9+15)
514Ø DEF FN C(R)=INT(RND(R)*6+3)
515Ø DEF FN D(R)=INT(RND(R)*2+1)
516Ø DEF FN E(R)=INT(RND(R)*8+1)
517Ø ST$="":FORI=1TO11:READA:ST$=ST$+CHR$(A):NEXT:REM{2
      SPACEs}TOP OF SHIP
518Ø DATA 32,66,69,7Ø,73,74,77,78,81,82,32
519Ø SB$="":FORI=1TO11:READA:SB$=SB$+CHR$(A):NEXT:REM{2
      SPACEs}BOTTEM OF SHIP
52ØØ DATA 67,68,71,72,75,76,79,8Ø,83,84,85
521Ø SL$="":FORI=43TO47:SL$=SL$+CHR$(I):NEXT:REM{2 SPAC
     Es}SCORE DISPLAY LINE
522Ø FORI=1TO6:READPT(I):NEXT:REM{2 SPACEs}POINT VALUES
523Ø DATA 15Ø,4Ø,25,75,2Ø,15
524Ø GOSUB 8ØØØ:REM{2 SPACEs}READ, POKE CUSTOM CHARACTE
     R SET
525Ø GOTO 6ØØØ
5997 *
5998 *{3 SPACEs}BEGIN GAME
5999 *
6ØØØ X=RND(-TI):PRINT "{SHFT CLR}{COMD 4}{CTRL 9}{3 SPA
     CEs}- BATTLESHIP WAR - BY KEITH MEADE{4 SPACEs}"
6Ø1Ø PRINT "{3 SPACEs}YOU ARE IN COMMAND OF A BATTLESHI
     P."
6Ø2Ø PRINT "{2 SPACEs}YOU HAVE 3 MINUTES TO DESTROY AS
     MANY"
6Ø3Ø PRINT "{3 SPACEs}ENEMY SUBS AND PLANES AS POSSIBLE
     "
6Ø4Ø PRINT "{2 CRSR DNs} POINT VALUES:"
6Ø5Ø PRINT "{CRSR DN} SMALL SUB = {CTRL 9}15Ø{CTRL Ø}{6
      SPACEs}SMALL PLANE = 75"
6Ø6Ø PRINT " MED SUB{3 SPACEs}= 4Ø{7 SPACEs}MED PLANE{3
      SPACEs}= 2Ø"
6Ø7Ø PRINT " LARGE SUB = 25{7 SPACEs}LARGE PLANE = 15{2
      CRSR DNs}"
6Ø8Ø PRINT "{CRSR DN}{5 SPACEs}CURSOR KEYS FIRE THE CAN
     NONS."
6Ø9Ø PRINT "{CRSR DN}{3 SPACEs}SPACE BAR RELEASES A DEP
     TH CHARGE.{3 CRSR DNs}"
61ØØ FOR X=1 TO 4Ø:NEXT
611Ø PRINT "{CRSR UP}{6 SPACEs}PRESS ANY KEY TO BEGIN P
     LAY"
612Ø FOR X=1 TO 4Ø:NEXT
613Ø PRINT "{CRSR UP}{6 SPACEs}{CTRL 9}PRESS ANY KEY TO
      BEGIN PLAY"
614Ø GET IN$:IF IN$="" GOTO 61ØØ
615Ø PRINT "{SHFT CLR}"
616Ø SCRAM=Ø:CHSET=2:REM{2 SPACEs}SCREEN RAM, CHAR SET
     LOCATION VALUES
617Ø GOSUB 1ØØØØ:REM{2 SPACEs}MOVE VIDEO BLOCK, ETC.
6175 REM{2 SPACEs}DRAW GAME DISPLAY
618Ø POKE 53281,5:PRINT "{SHFT CLR}{1Ø CRSR DNs}":POKE
     53281,1:REM{2 SPACEs}CLEAR, SET COLOR RAM
619Ø FORI=55296TO55695:POKEI,11:NEXT:REM{2 SPACEs}CHANG
     E SOME COLOR RAM
62ØØ PRINT "{COMD 7}";:FORI=1TO4Ø:PRINTCHR$(65);:NEXT:R
     EM{2 SPACEs}WATER LINE
621Ø PRINT "{2 CRSR UPs}{COMD 5}";SPC(13);ST$:REM{2 SPA
     CEs}SHIP TOP
622Ø PRINT SPC(13);SB$:REM{2 SPACEs}SHIP BOTTEM
623Ø PRINT "{COMD 4}";SL$;TPT:REM{2 SPACEs}SCORE LINE
624Ø FOR I=1 TO 3:X(I)=39:X(I+3)=Ø:NEXT:REM{2 SPACEs}RE
     SET TARGET POSITIONS
625Ø GOTO 1ØØ
```

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Listing continued.

```
 6997 *
 6998 *{4 SPACEs}GAME OVER
 6999 *
 7000 POKE 53281,7:REM{2 SPACEs}CHANGE SCREEN COLOR
 7010 FOR I=1 TO 2000:NEXT:REM{2 SPACEs}WAIT
 7020 POKE 53281,1:REM{2 SPACEs}RESTORE SCREEN COLOR
 7030 PRINT"{SHFT CLR}"
 7040 GOSUB 10100:REM{2 SPACEs}RESTORE VIDEO LOCATION
 7050 POKE 53272,(PEEK(53272) AND 240)+5:REM{2 SPACEs}RE
      STORE STANDARD CHARACTER SET
 7060 PRINT "{SHFT CLR}{4 CRSR DNs}TIME'S UP!!"
 7070 IF TPT>HIGAME THEN HIGAME=TPT
 7080 PRINT "{CRSR DN}YOUR SCORE =";TPT
 7090 PRINT "{CRSR DN}HIGH SCORE =";HIGAME
 7100 PRINT "{CRSR DN}ANOTHER GAME? (Y OR N)"
 7110 GET IN$:IF IN$="Y" THEN TPT=0:GOTO 6000
 7120 IF IN$<>"N" GOTO 7110
 7130 END
 7997 *
 7998 *{4 SPACEs}POKE CUSTOM CHAR DATA
 7999 *
 8000 M=34816
 8010 FORLIN=8040TO8350STEP10:TT=0:FORI=1TO16:READA:POKE
      M,A:M=M+1:TT=TT+A:NEXT
 8020 READA:IFTT<>ATHENPRINT"ERROR IN LINE";LIN:STOP
 8030 NEXT:RETURN
 8040 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,204,170,51,425
 8050 DATA 192,96,48,24,12,2,10,10,0,0,170,255,127,59,21
      ,14,1040
 8060 DATA 10,10,170,255,255,187,85,238,0,0,0,0,0,128,16
      0,160,1658
 8070 DATA 10,10,10,10,10,255,255,204,160,160,170,255,25
      5,187,85,238,2274
 8080 DATA 204,255,170,255,255,187,85,238,138,138,138,13
      8,138,255,255,204,3053
 8090 DATA 138,138,138,138,138,255,255,204,204,255,170,2
      55,255,187,85,238,3053
 8100 DATA 204,255,170,255,255,187,85,238,138,138,138,13
      8,138,255,255,204,3053
 8110 DATA 138,138,138,138,138,255,255,204,204,255,170,2
      55,255,187,85,238,3053
 8120 DATA 204,255,170,255,255,187,85,238,128,128,128,12
      8,128,193,197,197,2876
 8130 DATA 3,6,12,24,48,80,84,84,197,197,170,255,255,187
      ,85,238,1925
 8140 DATA 84,84,170,255,255,187,85,238,0,0,170,254,252,
      184,80,224,2522
 8150 DATA 0,48,49,255,255,49,48,0,3,6,12,255,255,6,3,1,
      1245
 8160 DATA 1,3,7,255,255,0,0,128,0,0,0,42,170,170,0,0,10
      31
 8170 DATA 40,80,160,170,170,170,80,40,1,2,5,170,169,170
      ,10,2,1439
 8180 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
 8190 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
 8200 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
 8210 DATA 0,12,12,255,255,0,0,0,0,0,0,0,255,127,63,0,97
      9
 8220 DATA 0,224,224,224,255,255,254,0,0,0,0,0,170,170,4
      2,10,1828
 8230 DATA 2,2,2,2,170,170,170,170,128,128,128,128,168,1
      70,170,168,1876
 8240 DATA 128,64,32,16,8,4,2,1,1,2,4,8,16,32,64,128,510
 8250 DATA 0,146,84,56,214,56,84,146,112,249,193,241,121
      ,25,249,240,2216
 8260 DATA 225,243,131,131,131,131,243,225,227,243,51,51
      ,51,51,243,227,2604
 8270 DATA 227,51,51,227,227,51,51,51,224,224,15,207,192
      ,15,239,224,2276
 8280 DATA 60,102,102,102,102,102,60,0,24,24,24,24,24,24
      ,24,0,798
 8290 DATA 124,6,6,12,48,96,126,0,124,6,6,28,6,6,124,0,7
      18
 8300 DATA 102,102,102,127,6,6,6,0,126,96,96,124,6,6,124
      ,0,1029
 8310 DATA 60,96,96,124,102,102,60,0,126,6,12,24,24,24,2
      4,0,880
 8320 DATA 60,102,102,60,102,102,60,0,60,102,102,62,6,6,
      60,0,986
 8330 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
 8340 DATA 0,0,0,0,0,0,0,0,192,6,48,0,3,192,12,0,453
 8350 DATA 112,216,112,0,14,27,14,0,0,0,0,60,126,60,0,0,
      741
 9995 *
 9996 *{2 SPACEs}MOVE VIDEO BLOCK TO #3
 9997 *{4 SPACEs}SET SCREEN RAM AND
 9998 *{4 SPACEs}CHAR SET LOCATIONS
 9999 *
10000 IF SCRAM<0 OR SCRAM>15 THEN PRINT "{CTRL 9} SCREE
      N RAM LOCATION ERROR ":STOP
10010 IF CHSET<0 OR CHSET>15 THEN CHSET=4
10020 POKE 56576,5:REM{2 SPACEs}VIDEO BLOCK LOCATION
10030 POKE 53272,16*SCRAM+CHSET:REM{2 SPACEs}SCREEN RAM
      ,CHAR SET LOCATION
10040 POKE 648,128+4*SCRAM:REM{2 SPACEs}NOTIFY BASIC
10050 RETURN
10097 *
10098 * RESTORE VIDEO TO NORMAL
10099 *
10100 POKE 56576,7:REM{2 SPACEs}VIDEO BLOCK
10110 POKE 53272,20:REM{2 SPACEs}SCREEN RAM, CHAR SET
10120 POKE 648,4:REM{2 SPACEs}BASIC'S SCREEN LOCATION
10130 RETURN
```

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SUPER DISK II Features and Specifications

COMPATIBILITY	Commodore 64,™ VIC-20,™ PET® CBM
BUFFER MEMORY CAPACITY	6K
COMPLETE DUPLICATION TIME: Format, Copy & Verify a Full Disk.	Less than 2 minutes. (Compare to 30-40 minutes with two 1541s).
TIME TO FORMAT	17 seconds. (Compare to 1 min/20 sec. with 1541).
SERIAL BUS	YES, 2 connectors.
PARALLEL BUS	YES, for enhanced speed, IEEE for Commodore compatibility.
DAISYCHAIN	Up to 4 drives
OPERATIONAL SUPPORT	• Power-on diagnostics to ensure proper disk drive operation. • LED status lights display where error is occurring. • Easy to understand instruction manual.
OVERHEAT TIME	NONE. Tested for weeks of continual operation.
WARRANTY	• 6 MONTHS. (Compare to 3 months for 1541). • 48 hour factory repair service. • Local service centers.

WHEN YOU ARE READY TO GET DOWN TO SERIOUS COMPUTING

RELIABLE SINGLE DRIVE READILY AVAILABLE

MSD Systems also offers COMMODORE OWNERS the reliable and efficient SUPER DISK I, a single disk drive which is compatible with the COMMODORE 64, VIC-20, and PET computers. Like the dual drive, MSD's SUPER DISK I never overheats . . . its internal state-of-the-art design provides exceptional durability and longer life even in continuous run cycles, with more speed and power for internal operations.

A greater 4K double capacity buffer memory allows users to open more files at any one time. The drive accomplishes many internal operations in less time than other single disk drives require. The SUPER DISK I can format disks in 17 seconds, and execute utility commands in a minimum amount of time.

The SUPER DISK I has both serial and parallel buses. Up to three times the serial communication's speed can be achieved by adding the MSD IEEE 488 interface (CIE) and IEEE/PET cable.

The unique vertical load architecture of MSD's SUPER DISKS reduces desktop space normally required. The durable sheet metal casing minimizes heat retention and contributes to the reliability and long life of the SUPER DISKS. MSD confidently offers an exceptional 6 month warranty to support SUPER DISK users.

MSD SUPER DISK DRIVE TECHNICAL SPECIFICATIONS

STORAGE*

Total Capacity	174848 bytes per diskette
Sequential	168656 bytes per diskette
Relative	167132 bytes per diskette 65535 records per file
Directory Entries	144 per diskette
Blocks	683 total per diskette 664 available per diskette
Tracks	35 per diskette
Sectors	17 to 21 per track
Bytes	256 per sector
Diskettes	Standard 5¼", single sided single density

*NOTE: The SD-2 contains two disk drive mechanisms and can therefore handle two times the above capacities (one for each diskette).

SOFTWARE

16K Bytes Operating System
4K RAM buffer area (6K for the SD-2)
Microprocessor based disk controller (6511Q)
Commodore Compatible Serial Bus Interface
Commodore Compatible IEEE Parallel Bus Interface

PHYSICAL DIMENSIONS

	SD-1	SD-2
Height	6.2" (157 mm)	6.2" (157 mm)
Width	4.2" (107 mm)	5.9" (150 mm)
Depth	13.3" (338 mm)	13.3" (338 mm)

INTERFACE

Dual Commodore compatible Serial Bus
Commodore compatible IEEE Parallel Bus
Jumpers for selecting device number 8, 9, 10 or 11.

ELECTRICAL REQUIREMENTS

Voltage	110 or optiona 220 VAC
Frequency	50 or 60 Hertz
Power	50 Watts

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IT'S YOUR TIME AND BOTTOM LINE!

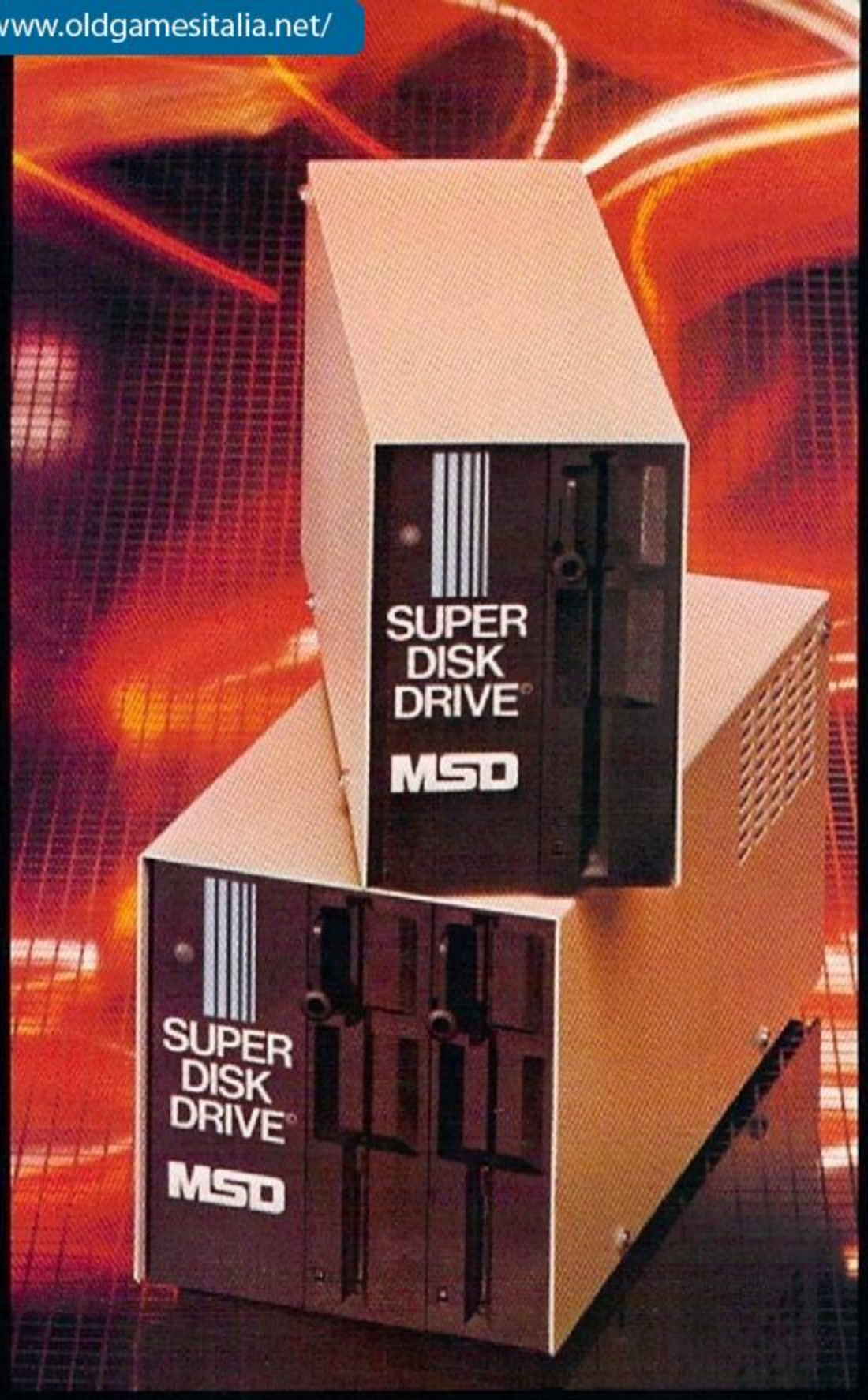
COMMODORE OWNERS now have an alternative to the frustrating LOAD ... wait ... UNLOAD ... wait ... RELOAD ... wait procedure. The NEW MSD DUAL DISK DRIVE ... SUPER DISK II will eliminate those hours wasted during task performance and time lags that inflate expensive labor costs and deflate your bottom line.

One SUPER DISK II will copy, format, and verify in less than two minutes ... a procedure that normally takes 30 to 40 minutes using 2 single drives. Yes, SUPER DISK II is TWENTY TIMES FASTER!

MSD provides quality craftsmanship that is backed by an exceptional six month warranty. The SUPER DISK II workhorse drive never overheats, so why be aggravated by the loss of time and money?

Invest today in SUPER DISK II, the SMART disk drive which contains its own microprocessor and memory enabling the computer to command the drive and then continue. SUPER DISK II does the work quickly so that you can get on with your program.

As for the money you will save in unproductive labor costs ... perhaps you will invest it in a daisychain of SUPER DISKS. These workhorse drives will allow you to connect up to four drives for maximum speed and reliable, continued performance.



SUPER DISK II DESIGN ASSETS

- Sturdy sheet metal casing and heat sink
- Vertical load for ergonomic space efficiency
- Key latch secures disk position
- Smart disk contains microprocessor and memory in each drive
- Status lights to display which drive is in use
- Three steel bands for repeated accuracy of alignment
- Flexible use of serial or parallel communication
- Access flexibility configured as drive 0 or drive 1

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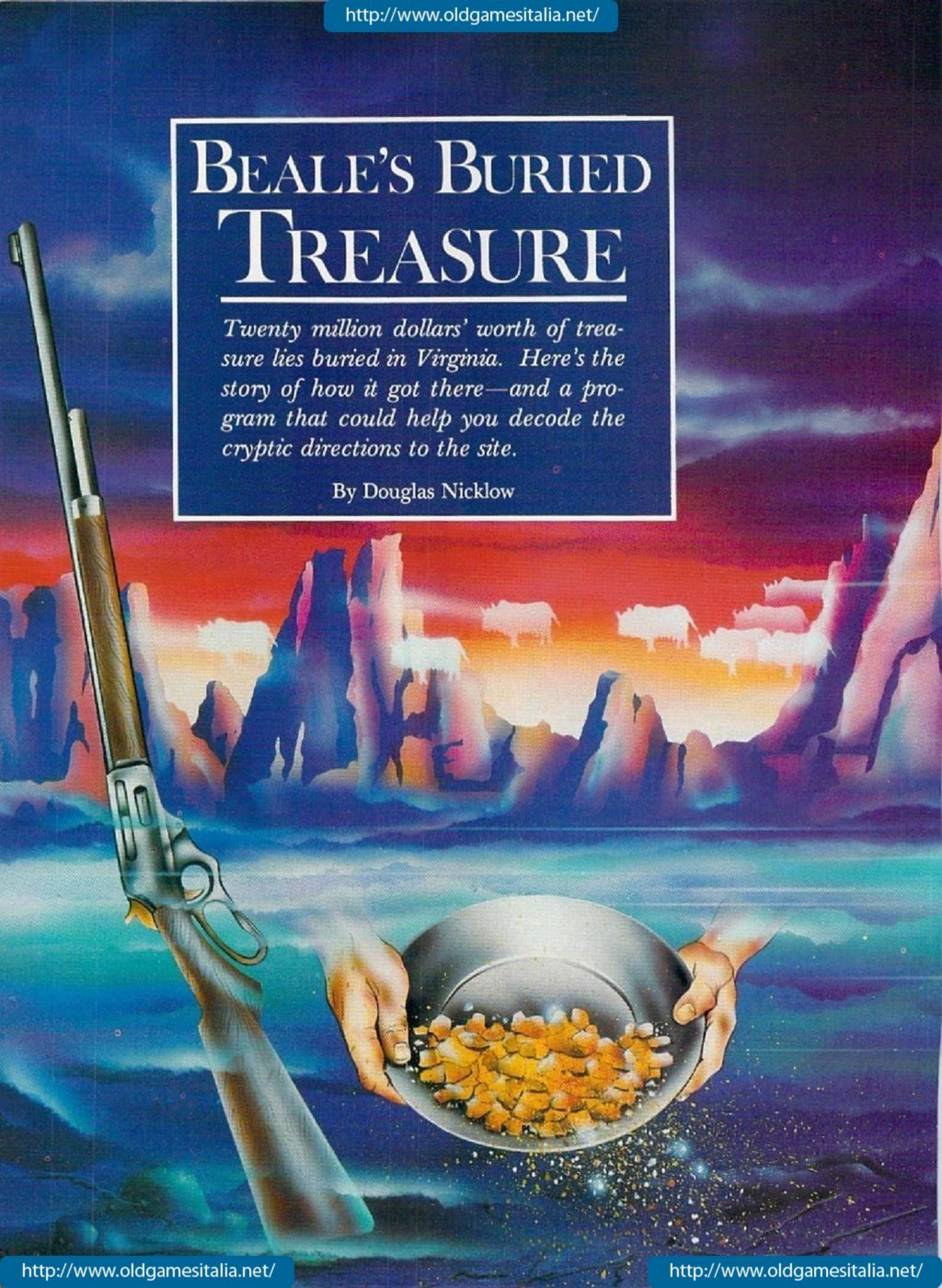
BEALE'S BURIED TREASURE

Twenty million dollars' worth of treasure lies buried in Virginia. Here's the story of how it got there—and a program that could help you decode the cryptic directions to the site.

By Douglas Nicklow



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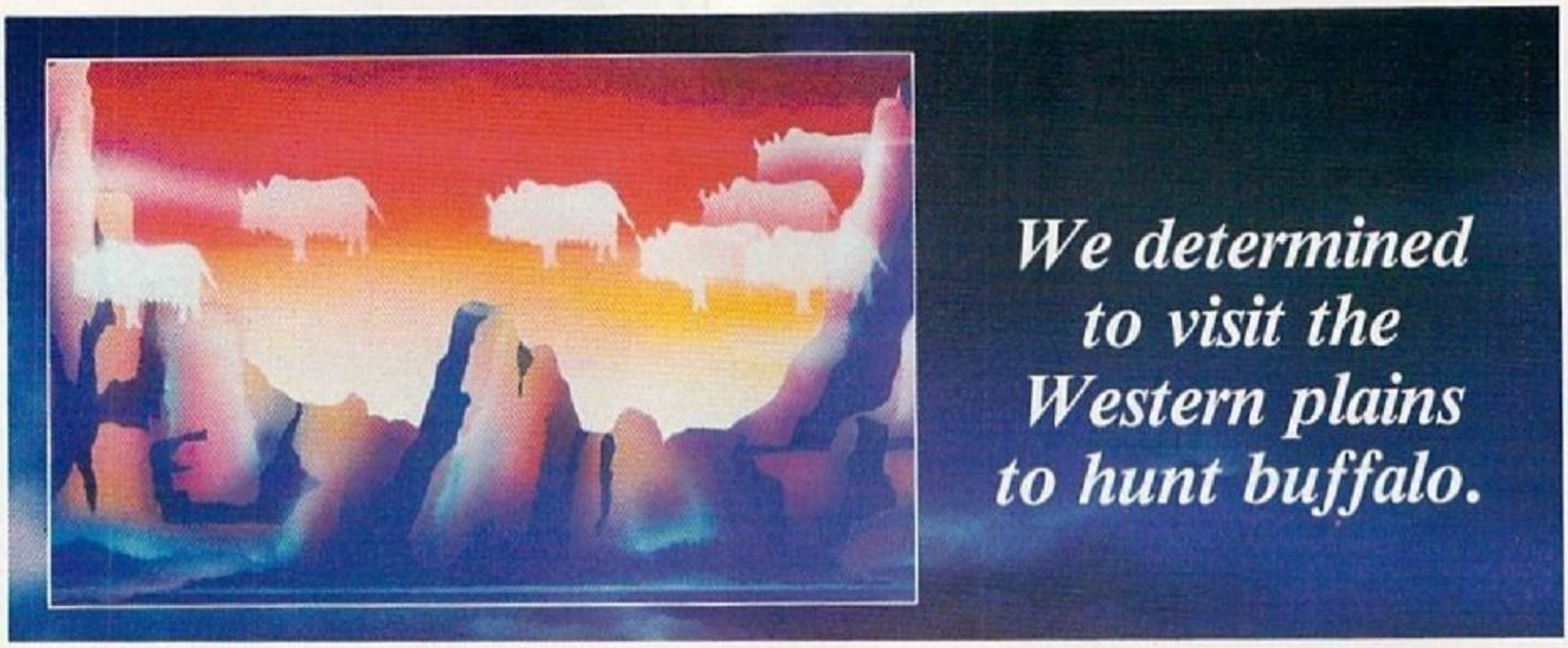

How many times have you dreamed of finding buried treasure? Surely the thought of uncovering untold wealth has crossed your mind, only to be dismissed as a passing fancy, a dream that could never be realized because of the time and money involved.

True enough, most large treasure-finds, such as gold-laden shipwrecked Spanish galleons, are the result of systematic approaches that require the seekers to devote months or years and in most cases huge investments of money. There is, however, one treasure that can be sought starting out from your own home. You'd probably think it definitely worth the effort, since the treasure consists of over $20 million in gold, silver and precious jewels.

Details about this treasure are well-known, including the general location, exactly what is buried, how it is buried and how it got there in the first place. The only, and most critical, thing not known is the *exact* burial spot. But even that information is available to treasure hunters in the form of a code. All you need do is crack the code, and the treasure is yours.

The treasure I'm referring to is known as the Beale Treasure. Its story begins in 1817, when Thomas Jefferson Beale, in the company of some 30 men, left Virginia on a hunting expedition to the West. The hunt succeeded beyond their wildest dreams, as you shall see.

In the winter of 1819, Thomas Beale appeared in Lynchburg, Virginia, at the inn owned and run by one Robert Morriss, a man with a wide reputation for exceptional integrity. Beale remained at the inn for some three months, getting to know Morriss and his family well, and in the process confirming for himself that the innkeeper's reputation was well deserved.

Beale then departed again for the West. After two more years, he reappeared at the inn in Lynchburg, this time for only a brief stay. Upon his departure after this second visit, Beale entrusted to Morriss a locked metal box, earnestly requesting that the innkeeper safeguard it with all care until Beale should return or until further instructions should arrive. This Morriss agreed to do.

The story behind the box and its contents is best revealed by Beale's own words in the following correspondence to Robert Morriss.

St. Louis, Missouri
May 9, 1822

Robt. Morriss, Esq.,

My esteemed friend:

Ever since leaving my comfortable quarters at your house, I have been journeying to this place, and only succeeded in reaching it yesterday. I have had, altogether, a pleasant time, the weather being fine and the atmosphere bracing. I shall remain here a week or ten days longer, then "ho" for the plains, to hunt buffalo and encounter the savage grizzlies. How long I may be absent I cannot now determine, certainly not less than two years, perhaps longer.

With regard to the box left in your charge, I have a few words to say, and, if you will permit me, some instructions to give you concerning it. It contains papers vitally affecting the fortunes of myself and many others engaged in business with me, and in the event of my death its loss might be irreparable. You will, therefore, see the necessity of guarding it with vigilance and care to prevent so great a catastrophe. It also contains some letters addressed to yourself and which will be necessary to enlighten you concerning the business in which we are engaged.

Should none of us ever return, you will please preserve the box carefully for a period of ten years from the date of this letter, and if neither I, nor anyone with authority from me, demands its restoration during that time, you will open it by forcing the lock.

You will find, in addition to the papers addressed to you, other papers which will be unintelligible without the aid of a key to assist you. Such a key I have left in the hands of a friend in this place, sealed, addressed to yourself and endorsed "Not to be delivered until June, 1832." By means of this key, you will understand fully all you will be required to do.

I know you will cheerfully comply with this request, thus adding to the many obligations under which you have already placed me. In the meantime, should death or sickness happen to you, to which all are liable, please select from among your friends someone worthy, and to him hand this letter, and to him delegate your authority.

I have been thus particular in my instructions in consequence of the somewhat perilous enterprise in which my associates and I are engaged, but trust you and I shall meet long ere the time expires, and so save you this trouble. Be

Address all author correspondence to Douglas A. Nicklow, Three Governor's Drive, Leesburg, VA 22075.

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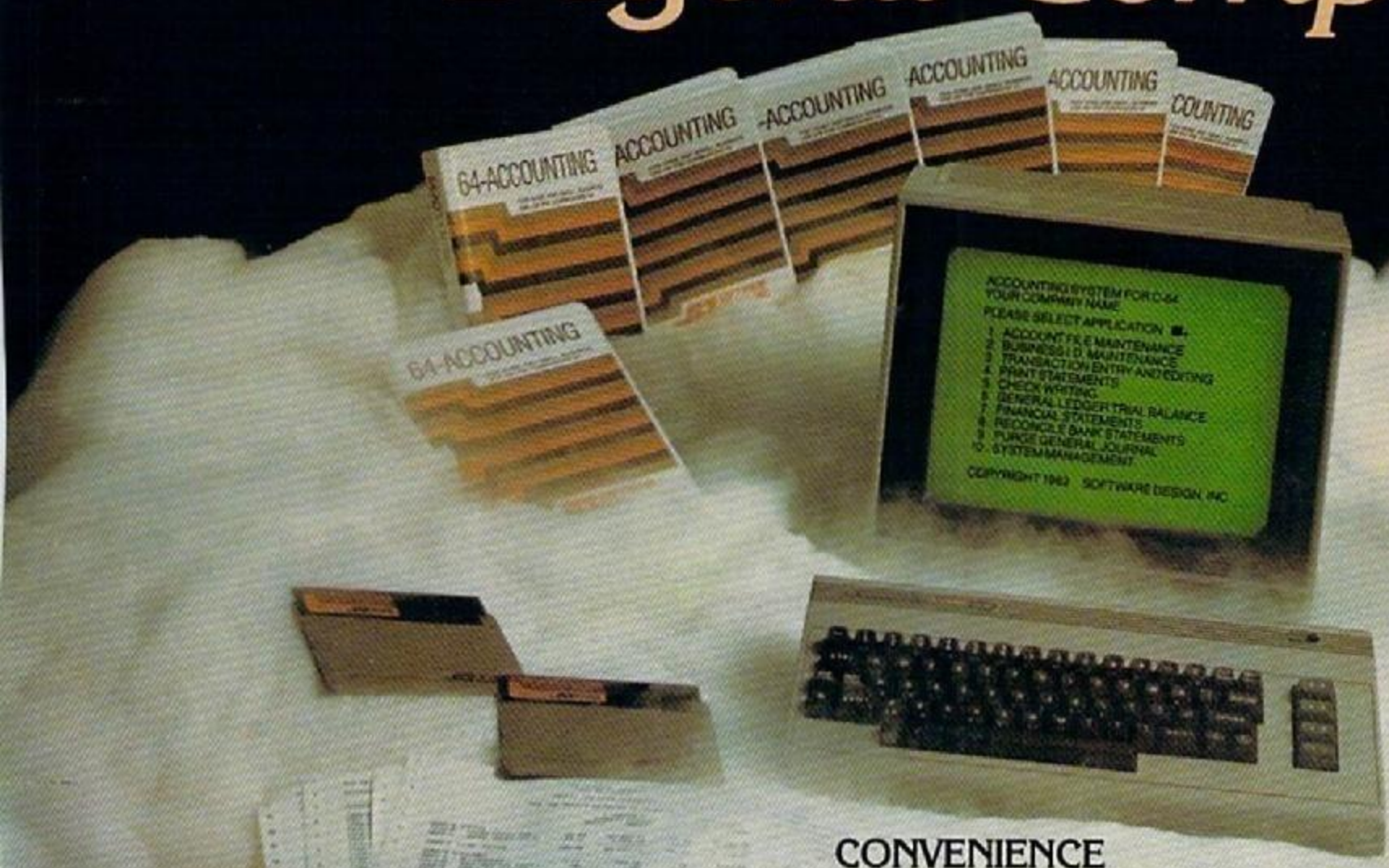
64 Software Beyond Compare



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the result what it may, however, the game is worth the candle, and we will play it to the end.

With kindest wishes for your most excellent wife, compliments to the ladies, a good word to enquiring friends, if any there be, and assurances of my highest esteem for yourself, I remain, as ever,

Your sincere friend,

Thos. Jeffn. Beale.

Ten years then passed, and Morriss had not heard from Beale. When the letter Beale had told him to expect in 1832 did not arrive, Morriss took no action, but instead held fast to the locked box and its contents. It was not until 1845 that Morriss opened the box to find three messages coded into numbers, as well as the following letters:

Lynchburg, Virginia
January 4, 1822

My dear friend Morriss:

You will, doubtless, be surprised when you discover, from a perusal of this letter, the importance of the trust confided to you, and the confidence reposed in your honor, by parties whom you have never seen and whose names you have never heard. The reasons are simple and easily told. It was imperative upon us that someone here should be selected to carry out our wishes in case of accident to ourselves, and your reputation as a man of integrity, unblemished honor and business sagacity influenced us to select you in place of others better known, but, perhaps, not so reliable as yourself.

It was with this design that I first visited your house, two years since, that I might judge by personal observation if your reputation was merited. To enable me the better to do so, I remained with you more than three months, until I was fully satisfied as to your character. This visit was made at the request of my associates, and you can judge from their actions whether my report was a favorable one.

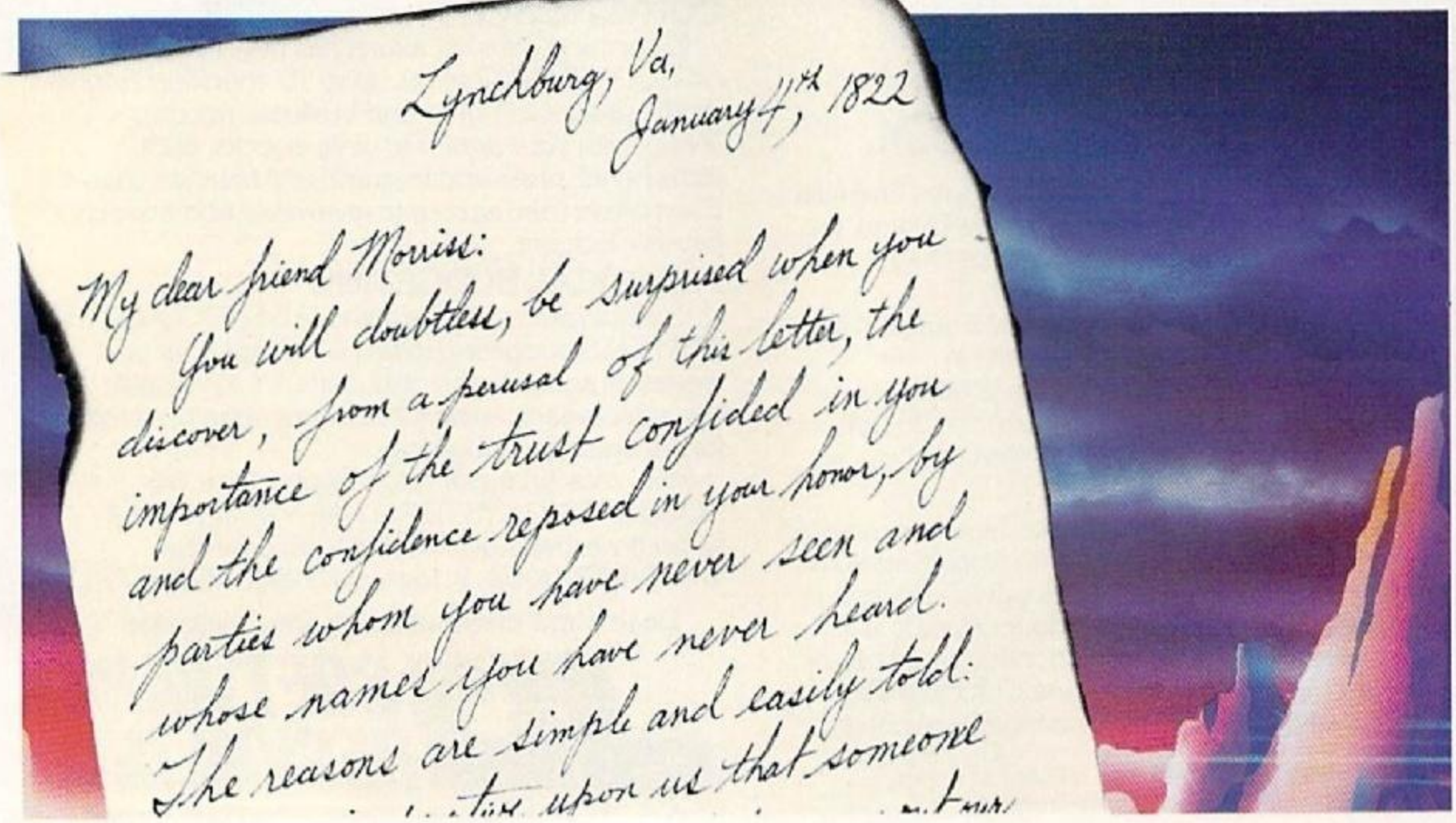
I will now give you some idea of the enterprise in which we are engaged, and the duties which will be required of you in connection therewith; first assuring you, however, that your compensation for the trouble will be ample, for you have unanimously been made one of our association, and as such are entitled to share equally with the others.

It is nearly five years since I, in connection with several friends, who, like myself, were fond of adventure, and if mixed with a little danger all the more acceptable, determined to visit the great Western plains to hunt buffalo, grizzly bears and such other game as the country would afford. This, at that time, was our sole object, and we at once proceeded to put it in execution.

On account of Indians and other dangers incident to such an undertaking, we determined to raise a party of not less than thirty individuals, of good character and standing, who would be pleasant companions and financially able to encounter the expense. With this object in view, each one of us approached several friends and acquaintances, and in a few weeks the requisite number had signed the conditions and were admitted as members of the party. Some few refused to join us, doubtless deterred by the dangers; but such men we did not want, and were glad of their refusal.

The company being formed, we forthwith commenced our preparations, and, early in April, 1817, left old Virginia for St. Louis, Missouri, where we expected to purchase the necessary outfits, procure a guide and two or three servants, and obtain such information and advice as might be beneficial hereafter. All was done as intended, and we left St. Louis the 19th of May. We intended to be absent two years, our objective point being Santa Fe, which we intended to reach in the ensuing fall, and there establish ourselves in winter quarters.

After leaving St. Louis, we were advised by our guide to form a regular military organization, with a captain, to be selected by the members, to whom should be given sole authority to manage our affairs, and, in case of necessity, to ensure united action. This was


Lynchburg, Va,
January 4th, 1822
My dear friend Morriss:
You will doubtless, be surprised when you
discover, from a perusal of this letter, the
importance of the trust confided in you
and the confidence reposed in your honor, by
parties whom you have never seen and
whose names you have never heard.
The reasons are simple and easily told:

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agreed to, and each member of the party bound himself by a solemn obligation to obey, at all times, the orders of the captain, or, in event of refusal, to leave the company at once.

This arrangement was to remain in force for two years, or for the period of our expected absence. Tyranny, partiality, incompetence, or other improper conduct on the part of the captain was to be punished by deposing him from his office if a majority of the company desired his dismissal. All this being arranged, and a set of laws framed, by which the conduct of the members was to be regulated, the election was held, and resulted in choosing me as the leader.

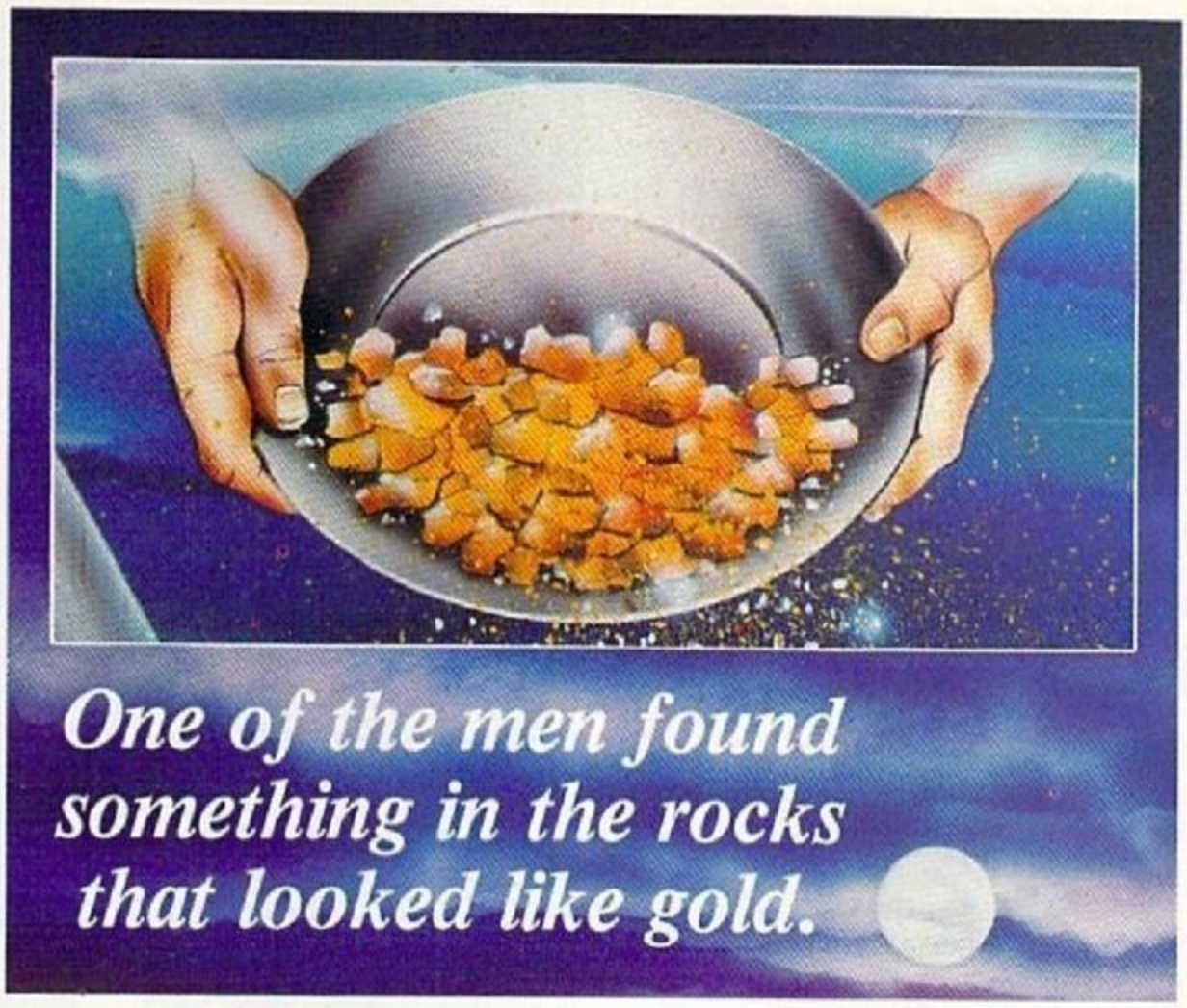
It is not my purpose now to give you details of our wanderings, or of the pleasures or dangers encountered. All this I will reserve until we meet again, when it will be a pleasure to recall incidents that will always be fresh in my memory.

About the first of December we reached our destination, Santa Fe, and prepared for a long and welcome rest from the fatigues of our journey. Nothing of interest occurred during the winter, and of this little Mexican town we soon became heartily tired. We longed for the advent of weather that would enable us to resume our wanderings and our exhilarating pursuits.

Early in March, some of the party, to vary the monotony of their lives, determined upon a short excursion, for the purpose of hunting and examining the country around us. They expected to be only a few days absent, but days passed into weeks, and weeks into a month or more, before we had any tidings of the party.

We had become exceedingly uneasy and were preparing to send out scouts to trace them, if possible, when two of the party arrived and gave an explanation of their absence. It appears that when they left Santa Fe, they pursued a northerly course for some days, being successful in finding an abundance of game, which they secured, and were on the eve of returning when they discovered an immense herd of buffalo heading for a valley just perceptible in the distance. They determined to follow them and secure as many as possible. Keeping well together, they followed the trail for two weeks or more, securing many and stampeding the rest.

One day, while following the buffalo, the party encamped in a small ravine, some 250 or 300 miles to the north of Santa Fe, and, with their horses tethered, were preparing their evening meal



One of the men found something in the rocks that looked like gold.

when one of the men discovered in a cleft of the rocks something that had the appearance of gold. Upon close examination by the others, it was pronounced to be gold, and much excitement was the natural consequence. Messengers were at once dispatched to inform me of the facts and request my presence with the rest of the party and supplies for an indefinite time.

All the pleasures and temptations which had lured them to the plains were now forgotten, and visions of boundless wealth and future grandeur were the only ideas entertained.

Upon reaching the locality, I found all as it had been represented, and the excitement intense. Everyone was diligently at work with such tools and appliances as they had improvised, and quite a little pile had already accumulated. Though all were at work, there was nothing of order or method in their plans, and my first efforts were to systematize our operations.

With this object in view, an agreement was entered into to work in common, as joint partners, the accumulations of each one to be placed in a common receptacle, and each to be entitled to an equal share of the whole whenever he chose to withdraw it; the whole to remain under my charge until some other disposition of it was agreed upon.

Under this arrangement, the work progressed favorably for eighteen months or more, and a great deal of gold had accumulated in my hands, as well as silver, which we had likewise found. Everything necessary for our purposes and for the prosecution of the work had been obtained from Santa Fe, and no trouble was experienced in procuring assistance from the Indians in our labors.

Matters went on thus until the summer of 1819, when the question of transferring our wealth to some secure place was frequently discussed. It was not considered advisable to retain so large an amount in so wild a locality, where its very possession might endanger our lives; and to conceal it there would avail nothing, as we might at any time be forced to reveal its hiding place.

We were in a dilemma. Some advised one plan, some another. One recommended Santa Fe as the safest place to deposit it, while others objected and advocated its shipment at once to the States, where it was ultimately to go, and where alone it would be safe. The idea seemed to prevail, and it was doubtless correct, that when outside parties ascertained, as they would do, that we kept nothing on hand to tempt their cupidity, our lives would be more secure than at present.

It was finally decided that it would be best to send the treasure to Virginia, under my charge, and there to securely bury it in a cave near Buford's Tavern, in the county of Bedford, that all of us had visited and all considered a perfectly safe depository. This was acceptable

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to all, and I at once made preparations for my departure. The whole party was to accompany me for the first five hundred miles, when all but ten would return, these latter to remain with me to the end of the journey. All was carried out as arranged, and I arrived safely with my charge.

Stopping at Buford's Tavern, where we remained for a month, under the pretense of hunting, we visited the cave but found it unfit for our purpose. It was too frequently visited by neighboring farmers, who used it as a receptacle for their sweet potatoes and other vegetables. We soon selected a better place, and to this the treasure was safely transferred.

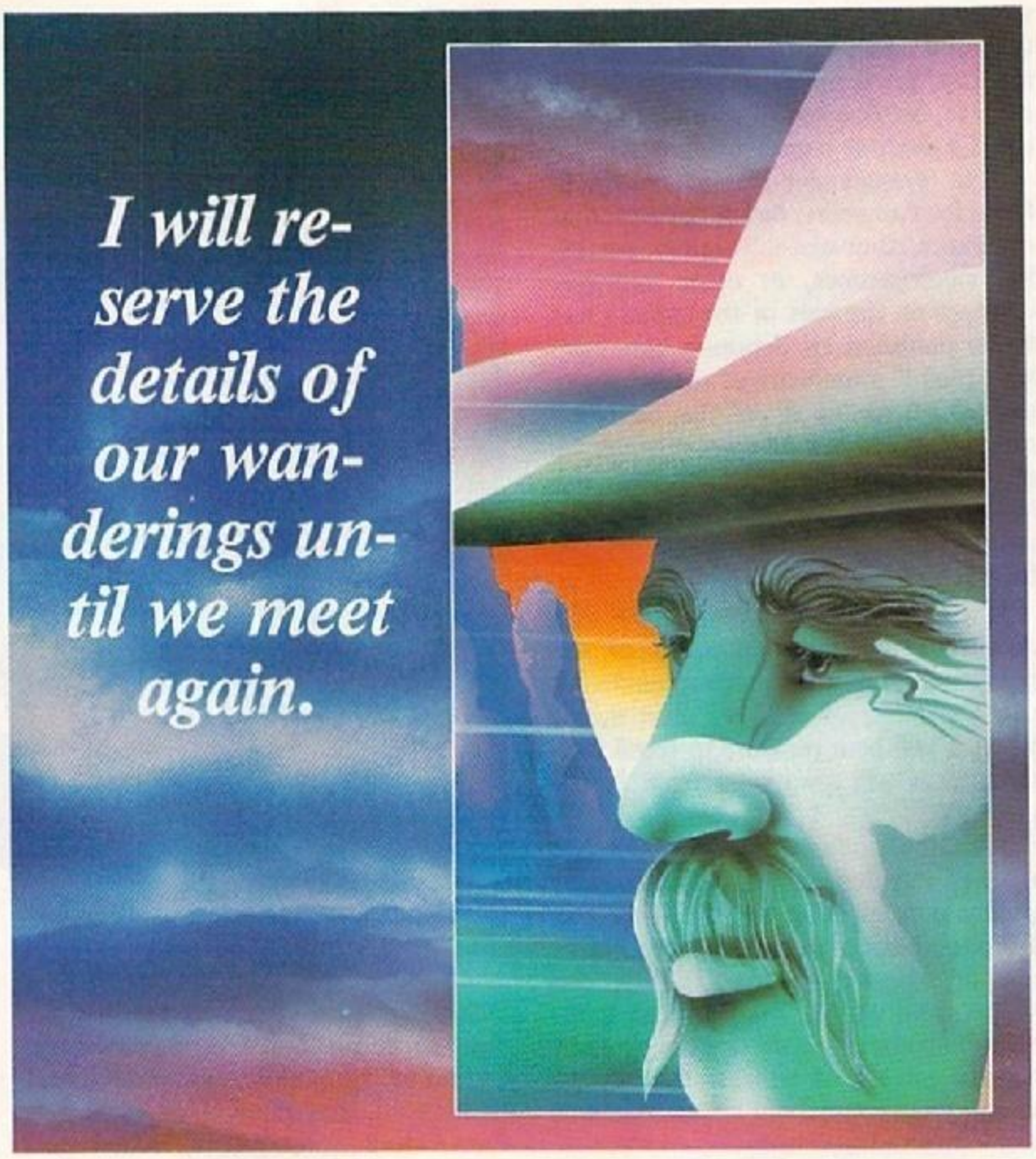
Before my departure for the East, my associates suggested that, in case of an accident to ourselves, the treasure so concealed would be lost to our relatives without some provision against such an occurrence. I was, therefore, instructed to select some perfectly reliable person, if such an one could be found, who should be confided in to carry out our wishes in regard to our respective shares, and upon my return report whether I had found such a person. It was in accordance with these instructions that I visited you, made your acquaintance, was satisfied that you would suit us, and so reported.

On my return I found the work still progressing favorably, and, by making large accessions to our force of laborers, I was ready to return last fall with an increased supply of metal, which came through safely and was deposited with the other. It was at this time I handed you the box, not disclosing the nature of its contents but asking you to keep it safely until called for. I intend writing you, however, from St. Louis, to impress upon you its importance still more forcibly.

The three coded papers enclosed herewith will be unintelligible without the key, which will reach you in due time. They will be found merely to state the contents of our depository, with its exact location, and a list of the names of our party, with their places of residence.

I thought, at first, to give you their names in this letter, but reflecting that someone may read the letter and thus be enabled to impose upon you by personating some member of the party, I have decided the present plan is best.

You will be aware from what I have written that we are engaged in a perilous enterprise, one which promises glorious results if successful; but dangers intervene, and of the end no one can tell. We can only hope for the best, and persevere until our work is accomplished and the sum secured for which we are striving.



As ten years must elapse before you see this letter, you may well conclude by that time that the worst has happened, and that none of us is to be numbered with the living. In such an event you will please visit the place of deposit and secure its contents, which you will divide into thirty-one equal parts. One of these parts you are to retain as your own, freely given for your services. The other shares are to be distributed to the parties named in the accompanying paper. These legacies, so unexpectedly received, will at least serve to recall names that may still be cherished, though partially forgotten.

In conclusion, my dear friend, I beg that you will not allow any false or idle punctillio to prevent your receiving and appropriating the portion assigned to yourself. It is a gift, not from myself alone, but from each member of our party, and will not be out of proportion to the services required of you.

I trust, my dear Mr. Morriss, that we may meet many times in the future, but if the Fates forbid, with my last communication I would assure you of the entire respect and confidence of

Your friend,
Thos. Jeffn. Beale

The second letter addressed to Morriss was:

Lynchburg, Virginia
January 5, 1822

Dear Mr. Morriss:

You will find, in one of the papers written in cipher, the names of all my associates, and opposite to the name of each one will be found the names and residences of relatives and others, to whom they devise their respective portions.

From this, you will be enabled to carry out the wishes of all by distributing the portion of each to the parties designated. This will not be difficult, as their residences are given, and they can easily be found.

T.J.B.

The Aftermath

After reading Beale's letters, Morriss realized that not far from him immense

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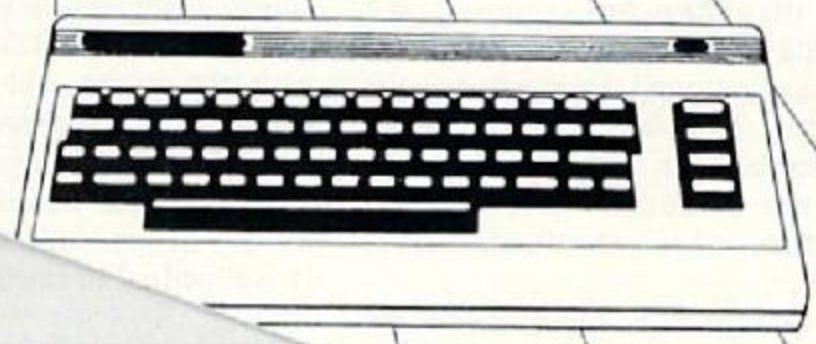

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wealth lay buried just a few feet underground. But try as he might, Morriss was unable to break Beale's code without the key in the letter that was never delivered.

A note that lends even more credibility to the entire fantastic story of the Beale Treasure is a discovery by J. Solario of the Brookings Institution. Solario discovered that the St. Louis Beacon of August 1832 printed a notice saying that the Post Office was holding a letter for Robert Morriss. Certainly this has to be more than a coincidence, considering the date the notice was published and the spelling of the name Morriss.

Morriss continued to work on the documents until 1862, when failing health caused him to turn the documents over to James Ward, a trusted and longtime friend. Morriss died three years later.

James Ward kept silent about the treasure for many years, working to solve the code and discover the location of the treasure. Finally Ward achieved a degree of success when he numbered the words of the Declaration of Independence and began substituting letters for numbers. Slowly the words contained in the second message formed:

"I have deposited in the County of Bedford, about four miles from Buford's, in an excavation or vault six feet below the surface of the ground, the following articles belonging jointly to the parties whose names are given in number three herewith. The first deposit consisted of ten hundred and fourteen pounds of gold and thirty-eight hundred and twelve pounds of silver, deposited Nov, eighteen-nineteen. The second deposit was made Dec, eighteen-twenty-one and consisted of nineteen hundred and seven pounds of gold and twelve hundred and eighty-eight of silver; also jewels obtained in St. Louis, in exchange to save transportation, and valued at thirteen thousand dollars. The above is securely packed in iron pots with iron covers. The vault is lined with stone, and the vessels rest on solid stone, and are covered with others. Paper number one describes the exact locality of the vault, so that no difficulty will be had in finding it."

Ward then eagerly tried the substitution on the other messages, only to find the substitution meaningless. He continued to work on the codes, but never succeeded in breaking either of the remaining two. Finally, in 1885 he made the story public, attempting to make a profit for the years he spent working on the code. Ward had a pamphlet, titled The Beale Papers, printed by the Virginia Job Print Company in Lynchburg, with the intention of selling each for fifty cents a copy. Bad luck continued to follow Ward, however, and he was never able to sell the pamphlets. A fire broke out in the printing company and most of them were destroyed. A few copies survived and these were given to friends.

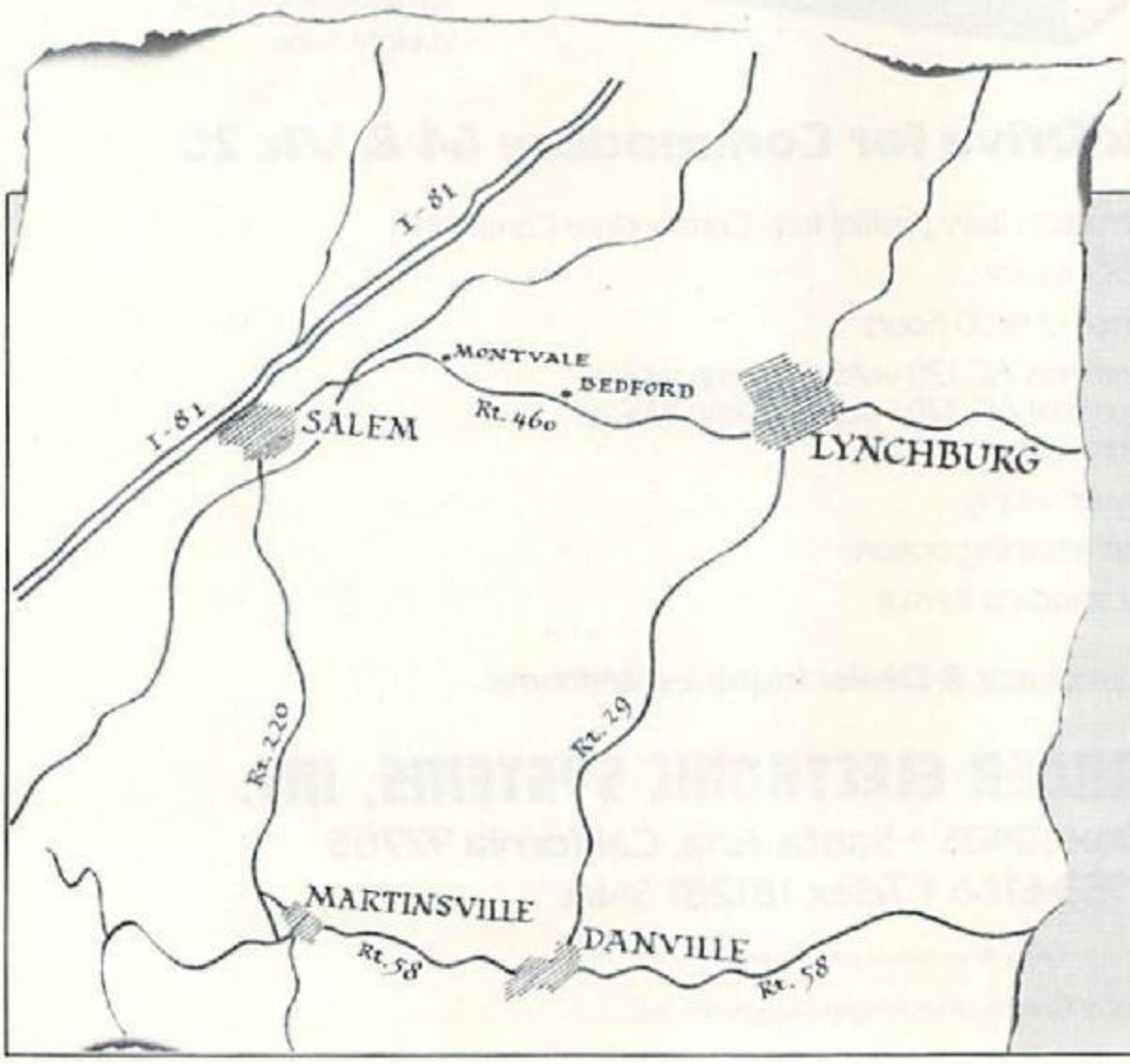
The Hunt

To date, the treasure remains safely buried where Beale and his men placed it. At least, no one has claimed to have found it.

If your interest has been piqued by the story (or should I say legend?) of the Beale Treasure, then perhaps you'd like to give the code a try. Your home computer is an excellent tool for this quest, as is the program that accompanies this article.

All three of Beale's codes are contained as Data statements within the program; code 1 from line 1200 to 1660; code 2 from 1730 to 2220; and code 3 from 2280 to 2680. Also included, in Data statements 2750 to 3930, is the Declaration of Independence, the key to code 1 that James Ward discovered.

The program is designed for maximum flexibility, allowing you to choose the code you'd like to work on. After selecting the code, you're given the opportunity to substitute the first letter of the Declaration of Independence. Fig. 1 shows the substitution for code 2, the contents of the treasure. Notice that county is misspelled, as is excavation. The reason for this is that neither Y nor X appears as the first letter of a word in the Declaration of Independence. However, the 822nd word, fundamentally,



It was finally decided to bury the treasure in a cave near Buford's Tavern.

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ends with Y and the 994th word, sexes, has an X that falls directly in the middle. Even without these clues, the values of these letters can be guessed from reading the rest of the message.

Figures 2 and 3 show the substitutions obtained for codes 1 and 3, respectively. Just as James Ward discovered, these substitutions make no sense. As a tool, though, the program allows you to make any letter substitutions you wish for code values. In this manner, you can attempt to use any document that comes to mind, or even rely to some degree on intuition.

At this point, I feel I must warn you that all types of documents have been tried, unsuccessfully, in attempts to break the code. Some treasure hunters, however, feel that only the Declaration of Independence was used in creating the codes—just in different ways for each.

If this is the case, then a home computer equipped with Basic and its string-handling abilities certainly is a useful tool. By altering the Print statement in line 560, it's possible to come up with thousands of possible combinations from the Declaration alone.

With Beale's letters to Robert Morriss and the codes, you have the same information available to you that Morriss and Ward had to them. Perhaps the letters themselves are the key. A straight substitution of the letters isn't. I know, for I've tried that much, myself.

One thing is certain; even if you're not successful in deciphering the code, you're sure to improve your Basic string-handling abilities in modifying the program. And if you are successful in solving the code, the treasure at current market values would be worth in excess of 20 million dollars.

Should you happen on the key, a map of the area is provided. Buford is now known as Montvale. I strongly suggest that if you dig, you don't trespass—ask the property owner's permission.

If you'd like to pursue the computer search further, but want to save a little time, I'm willing to provide a copy of the program, as well as Beale's letters as Data statements. Just send me $5, a blank cassette tape or disk and a stamped, self-addressed mailer. Happy hunting! R

```
IHAVEDEPOSITEDINTHECOUNTFOFBEDFORDABOUTFOURMILESFROMBUFORDSINANESCAVATIONORVAULT
SISFEETBELOWTHESURFACEOFTHEGROUNDTHEFOLLOWINGARTICLESBELONGINGJOINTLFTOTHEPARTIE
SWHOSENAMESARGIVENINNUMBERTHREEHEREWITHTHEFIRSTDEPOSITCONSISTEDOFTENHUNDREDANDF
OURTEENPOUNDSOFGOLDANDTHIRTEIGHTHUNDREDANDTWELVEPOUNDSOFSILVERDEPOSITEDNOVEIGHT
EENNINETEENTHESECONDWASMADEDECEIGHTEENTWENTFONEANDCONSISTEDOFNINETEENHUNDREDANDS
EVENPOUNDSOFGOLDANDTWELVEHUNDREDANDEIGHTEIGHTOFSILVERALSOJEWELSOBTAINEDINSTLOUI
SINESCHANGETOSAVETRANSPORTATIONANDVALUEDATTHIRTEENTHOUSANDDOLLARSTHEABOVEISSECUR
ELFPACKEDINIRONPOTSWITHIRONCOVERSTHEVAULTISROUGHLFLINEDWITHSTONEANDTHEVESSELSRES
TONSOLIDSTONEANDARECOVEREDWITHOTHERSPAPERNUMBERONEDESCRIBESTHEEXACTLOCALITFOFTHE
VAULTSOTHATNODIFFICULTFWILLBEHADINFINDINGIT
```

Fig. 1. The contents of the treasure, decoded.

```
SCS-ETFA-GCDOTTUCWOTWTARIWDBIIDTT-WTTAABBPLAAABNCTLTFIFLXILPEAABPWCHOTOAPPPMORAL
ANHAABBCCACDDEAOSDSFHNTFTATPOCACBCDDLBERIFEBTHIFOENUUBTTTTTIHPAORASATAATTOMTAPOA
AAPOMPJDRA--TSBCOBDMAACPNRBABFDEFOHIIJKLMNOHPPAWTACMBLSOESSOAVISPFTAOTBTFTHFORO
GHWTENALCAASAATTARTSLTAWGFESAUWAOLTTAHHTHSOTTEHFAASCSTAIFRCABTOTLAHDTNHWTSTEAIE
OAASTWTTSOITSSTAAOPFWCPCWSTTIOIEATTTDATTPIUFSORFABPTCCOAITNATTOSTSTF--ATDATWTATT
OCWTONPATSOTECATTOTBSOGCWCDROLITIBHPWHNE-BTSTAPHEWCA-CEOWLTPOACTEWTAFOAITHTTTTOS
HRISTETOECUSC-RAIHRLWSTRASNITPCBFAEFTB
```

Fig. 2. The first code message.

```
AICHREIHARHTTSTTDAADLATAOCTTAWTPSEEWDTTBOAFRNATHDNFOEBOTAABNPSOBTLAIATSBOEIINRAN
TALEEHMTAOGITMEAASRETHOEABTTPEAACCTTDCGRATRIWTIDTPHBEOFOASFOBTDMMATWTACCSTTTEBAW
ATTTAAANHRTTJBOLRTCARSOTNOTTNCTEANBTIOOAETAGISWAFATHUOAWTWPTTHATTETISOLSWTCOHATT
EOEEAWPAOLHLTRTETAWISBOHOCGDRTFEMFBASAAATECOCTARAENTTAROTLSCOTSFTONAEATTASWBSTUI
GMBOEWTPTLATDCKAADBCSCWTCGROCRMEWMTSFTBWTMUATTTOSSEDAETEATRTOSDTTTOTWTITPHBPLOTF
FBRTNDWWSCJBWHERBGBTLGHTUETTWRALBITATWRGAWPMGPTTGITTWTDJFTTHCSWTLCOERTSWATMOOORO
ORPTWDTBTLOETAAITTPDAERARCTBITAJLSHECBCTDMTOTTTRDDMTWOOHSTDTHRCACMEOOCHWWTFSLWWE
CRCMITAEDTREHOSNEWTNHRCTIIBWMAOOOONTBOTALTTAAEOSTFATWHBJAB
```

Fig. 3. The third code message.

RUN It Right

Commodore 64

Listing of Beale Treasure code.

```
100 REM{10 SPACEs}BEALE CODE
110 :
120 REM{3 SPACEs}TREASURE HUNTING AT HOME
130 :
140 REM{8 SPACEs}BY D.A.NICKLOW
150 REM{8 SPACEs}23 FEBRUARY 83
160 :
170 :
180 B$="{39 SPACEs}"
190 DIM DC$(2906),C$(763),C(763)
200 PRINT CHR$(147)
210 PRINT:PRINT:PRINT "SELECT CODE TO WORK "
220 PRINT
230 PRINT "{2 SPACEs}1 - TREASURE LOCATION "
240 PRINT "{2 SPACEs}2 - TREASURE CONTENTS "
250 PRINT "{2 SPACEs}3 - BEALE PARTY MEMBERS"
260 PRINT:PRINT
270 INPUT "{CRSR UP}{2 SPACEs}CHOICE ";QA
280 :
290 IF QA = 1 GOTO 340
300 IF QA = 2 GOTO 390
310 IF QA = 3 GOTO 440
320 GOTO 270
330 :
340 WL = 518
350 GOSUB 930:GOSUB 760
360 GOSUB 830:GOSUB 760
370 GOSUB 880:GOSUB 760
380 GOTO 480
390 WL = 763
400 GOSUB 780:GOSUB 760
410 GOSUB 980:GOSUB 760
420 GOSUB 880:GOSUB 760
430 GOTO 480
440 WL = 618
450 GOSUB 780:GOSUB 760
460 GOSUB 830:GOSUB 760
470 GOSUB 1030:GOSUB 760
480 GOSUB 1090
490 READ A$:IF A$<> "NNNNNNNNNN" THEN PRINT "READ ERROR
    ":END
500 PRINT
510 INPUT "USE DECLARATION (Y/N) ";QA$
520 IF QA$ = "N" THEN 600
530 IF QA$ <> "Y" THEN 500
540 PRINT CHR$(147)
550 FOR X = 1 TO WL
560 :{3 SPACEs}PRINT LEFT$(DC$(C(X)),1);
570 NEXT X
580 PRINT:PRINT:PRINT "PRESS ANY KEY TO EXIT"
590 GET A$:IF A$="" THEN 590:GOTO 200
600 PRINT CHR$(147)
610 PRINT "{HOME}"
620 FOR X = 1 TO WL
630 :{3 SPACEs}PRINT C$(X);
640 NEXT X
650 PRINT:PRINTB$:PRINT
660 PRINT "INPUT CODE VALUE / LETTER ASSIGNMENT"
```

(continued on p. 108)

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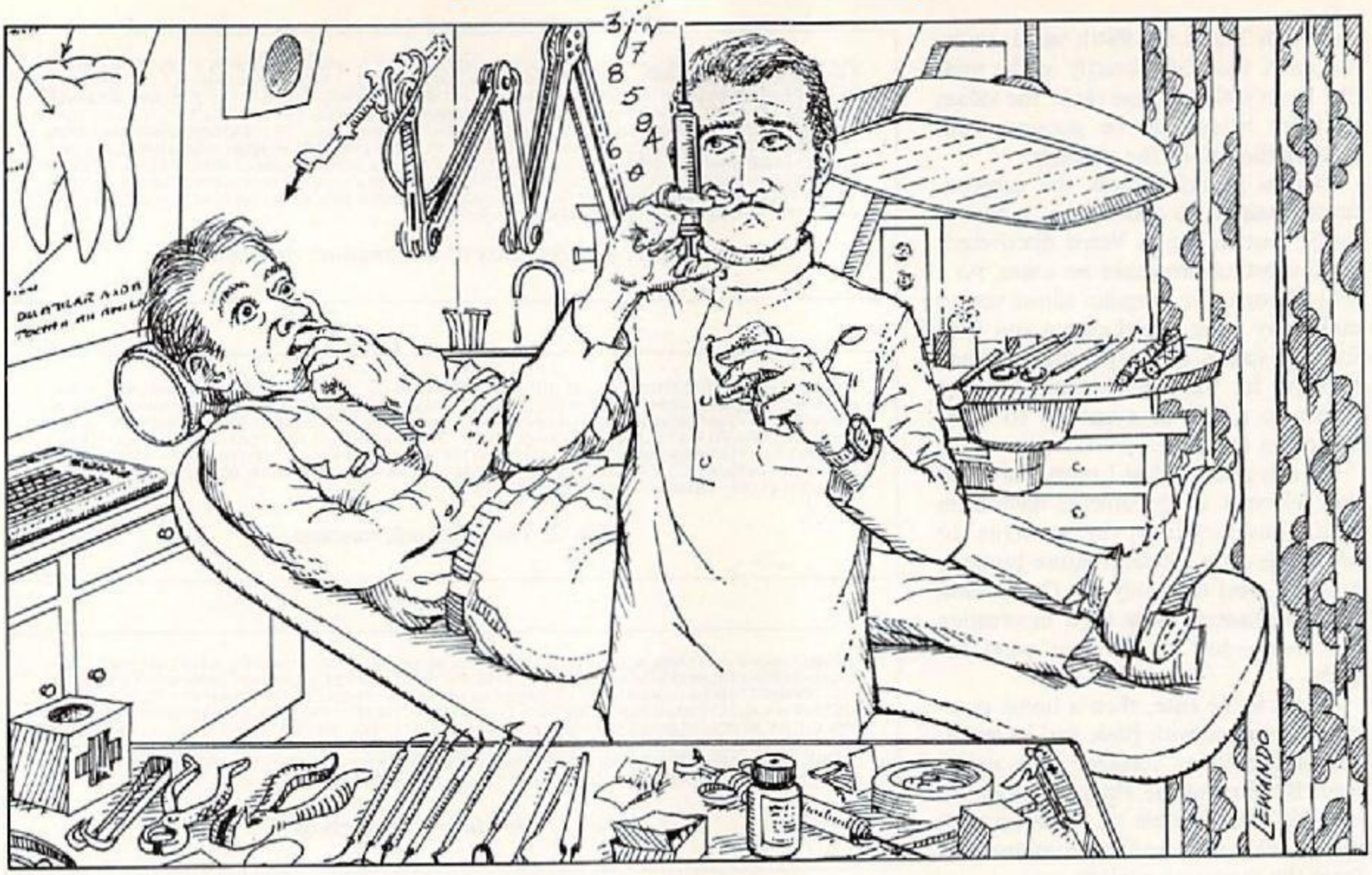

Pokes Without Pain

By Craig Howarth

Do you shudder at doing the calculations in figuring the Poke values for your custom-designed graphics characters? Well, quake no more—this program will ease and speed your work.

If you have ever designed a screen using all your Commodore keyboard graphics, you've probably spent many hours calculating the Poke values and locations of each character. The tedium involved in calculating these screen designs is only slightly relieved by the use of graph paper. There's a better way, and your computer, not you, does much of the work.

The Screen Graphics Designing Aid relieves you of calculating the value of each character on the screen, its location in screen memory, its color value and its location in color memory. This program is useful when you're going to Poke your design onto the screen in your own program.

RUN It Right

VIC-20 or C-64

Address author correspondence to Craig Howarth, 1411 Aurora Hudson Road, Aurora, OH 44202.

There are two versions of the Screen Graphics Designing Aid, one for the VIC-20 (expanded or unexpanded) and one for the C-64. Since they are virtually identical, I'll be referring only to the 64, but the given information applies to the VIC-20 as well, unless otherwise noted.

After typing this program into your computer, save it before using it. The program uses many Pokes, so if you've made a mistake in typing it, you may lose the program when running it.

To use the Screen Graphics Designing Aid (SGDA) you must first load it into your 64, but *don't* immediately run it. Once SGDA is loaded, clear the screen and begin creating your screen design. You may use any characters that are available from the keyboard (even reverse). The only limitation is that there be nothing in the first line.

When you have completed your screen design, move the cursor to the top of the screen, type RUN and press the return key. After the titles appear, you'll be prompted to make a choice between the output going to the screen or to the printer.

If you choose output to the screen, you'll need to use a joystick (in port two) to move the cursor, which should now be in the center of your screen. Five numbers will also appear at the top of your screen (four on the VIC-20). They are, in order:

- Screen location
- Offset value (not included on the VIC-20)

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- Character code
- Color location
- Color code

The numbers represent the cursor's location and what was previously at that location. The screen location is the memory location where you would Poke a number to have its character representation appear on the screen at that spot.

The offset value is the number of spaces from the beginning of the screen to the current location.

The character code is the number representing the character that was previously at the cursor's location.

The color location is the memory location that holds the color value for that spot on the screen.

Finally, the color code is the color of that location before the cursor appeared.

The VIC-20 version will work with or without memory expansion and will provide the proper memory locations for both the screen location and the color location, depending on the amount of memory used.

You cause the numbers to change by moving the cursor. Also, the locations are restored to their original state when the cursor leaves a spot.

If you own a 1515, a 1525 or some other printer with a suitable interface (I use a Gemini 10X with a Cardco Card? +G interface), you may get a hardcopy printout of the information on the screen.

When you're asked by SGDA to choose the mode of output, type P, sit back and relax. The computer will supply information on each location, provided it does not contain a space. The printout will contain all the information given on the screen display, as well as the color value of the screen background and border.

If you do not own a printer, there's no need for you to type in the section of code devoted to the printer. So, eliminate lines 1000 and on, as well as lines 220–250.

I find that by using the Screen Graphics Designing Aid, I am able to do in half an hour what previously took me one or two hours. This program allows me to create my design directly on the screen, so I may visualize my ideas better than if they were on graph paper.

Also, SGDA eliminates having to look through books at all the charts required to do the same work. When the design is complete, the numbers required to reproduce the design are provided instantly. Let the computer do the dull work, while you do the creating. R

Listing 1. SGDA program for the VIC-20.

```
10 REM **************
15 REM
20 REM SCREEN GRAPHIC
30 REM DESIGNING AID
40 REM
45 REM VIC-20 VERSION
50 REM
55 REM BY
60 REM CRAIG HOWARTH
90 REM
95 REM *************
96 REM INITIALIZE
97 REM VARIABLES
98 REM *************
99 REM
100 IF PEEK(44)=18 THEN 105
103 SS=7680:CS=38400:GOTO 107
105 SS=4096:CS=37888
107 CD=CS-SS
110 SC=36879:JY=37137:JK=37154
120 TL=SS+22:BL=SS+505:PO=SS+252:PC=PO+CD
130 DIM JO(13)
140 FOR I=1TO13:READ JO(I):NEXT
150 DATA 21,-23,-1,,22,-22,,,,,1,-21,23
155 SP$=CHR$(19):FOR I=1TO22:SP$=SP$+CHR$(32):NEXT:SP$=
    SP$+CHR$(19)
200 REM
201 REM ****
202 REM TITLES
203 REM ****
204 REM
205 PRINT SP$
210 PRINT"{HOME}{3 SPACEs}SCREEN GRAPHICS{3 SPACEs}{HOM
    E}":FORT=1TO1000:NEXT
212 PRINT"{HOME}{4 SPACEs}DESIGNING AID{4 SPACEs}{HOME}
    ":FORT=1TO1000:NEXT
215 PRINT"{HOME}{2 SPACEs}BY CRAIG HOWARTH{3 SPACEs}{HO
    ME}":FORT=1TO1000:NEXT
220 PRINT"{HOME}OUTPUT: {CTRL 9}S{CTRL 0}CREEN {CTRL 9}
    P{CTRL 0}RINTER{HOME}"
230 A$="":GETA$:IFA$=""THEN230
240 IF A$="P" THEN 1000
245 IF A$="S" THEN 300
250 GOTO 230
300 REM
301 REM ***********
302 REM OUTPUT TO
303 REM SCREEN
304 REM ***********
305 REM
310 CN=PEEK(PO):CO=PEEK(PC)AND15
320 POKE PC,2:POKE PO,42
325 PRINT SP$
330 PRINT CHR$(19);PO;CN;PC;CO;CHR$(19)
340 POKE JK,127:JS=(PEEK(JY)AND28) OR (PEEK(JY+15)AND12
    8):POKE JK,255
342 JS=ABS(JS-100)/4-7
345 TP=PO+JO(JS)
350 IF TP<TL OR TP>BL OR JS=7 THEN 340
360 POKE PC,CO:POKE PO,CN
370 PO=TP:PC=PC+JO(JS)
380 GOTO 310
1000 REM
1001 REM ************
1002 REM OUTPUT TO
1003 REM PRINTER
1004 REM ************
1005 REM
1010 PRINTSP$
1020 OPEN4,4:CMD4
```

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Listing continued.

```
1030 PRINT CHR$(16)"25SCREEN GRAPHICS DESIGNING AID"
1040 PRINT CHR$(16)"32BY CRAIG HOWARTH"
1050 PRINT:PRINT
1060 PRINT "SCREEN & BORDER COLOR:";PEEK(SC)
1080 PRINT
1090 PRINT "SCREEN LOCATION";
1100 PRINT CHR$(16)"18OFFSET VALUE";
1110 PRINT CHR$(16)"33CHARACTER CODE";
1120 PRINT CHR$(16)"50COLOR LOCATION";
1130 PRINT CHR$(16)"67COLOR CODE"
1140 PR=TL
1150 CN=PEEK(PR):CO=PEEK(PR+CD)AND15
1153 POKE PR+CD,0:POKE PR,42
1155 IF CN=32 OR CN=96 THEN 1205
1160 PRINT CHR$(16)"05";PR;
1170 PRINT CHR$(16)"21";PR-SS;
1180 PRINT CHR$(16)"37";CN;
1190 PRINT CHR$(16)"53";PR+CD;
1200 PRINT CHR$(16)"70";CO
1205 POKE PR+CD,CO:POKE PR,CN
1210 PR=PR+1
1220 IF PR>BL THEN 1999
1230 GOTO 1150
1999 PRINT#4:CLOSE4
```

Listing 2. SGDA program for the C-64.

```
10 REM ******************************
20 REM *{28 SPACEs}*
30 REM * SCREEN GRAPHICS DESIGNING{2 SPACEs}*
40 REM *{12 SPACEs}AID{13 SPACEs}*
50 REM *{28 SPACEs}*
60 REM *{8 SPACEs}64 VERSION{10 SPACEs}*
70 REM *{28 SPACEs}*
75 REM *{5 SPACEs}BY CRAIG HOWARTH{7 SPACEs}*
78 REM *{28 SPACEs}*
80 REM ******************************
90 REM
95 REM *************
96 REM INITIALIZE VARIABLES
97 REM *************
98 REM
100 SS=1024:CS=55296:CD=CS-SS
110 BC=53280:SC=53281:JY=56320
120 TL=1064:BL=2023:PO=SS+500:PC=PO+CD
130 DIM JO(10)
140 FOR I=1TO10:READ JO(I):NEXT
150 DATA -40,40,,-1,-41,39,,1,-39,41
155 SP$=CHR$(19):FOR I=1TO40:SP$=SP$+CHR$(32):NEXT:SP$=
    SP$+CHR$(19)
200 REM
201 REM ****
202 REM TITLES
203 REM ****
204 REM
205 PRINT SP$
210 PRINT"{HOME}{4 SPACEs}SCREEN GRAPHICS DESIGNING AID
    {6 SPACEs}{HOME}":FORT=1TO1000:NEXT
215 PRINT"{HOME}{11 SPACEs}BY CRAIG HOWARTH{11 SPACEs}{
    HOME}":FORT=1TO1000:NEXT
220 PRINT"{HOME}CHOOSE OUTPUT: {CTRL 9}S{CTRL 0} - SCRE
    EN{2 SPACEs}{CTRL 9}P{CTRL 0} - PRINTER{HOME}"
230 A$="":GETA$:IFA$=""THEN230
```

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Listing continued.

```
  240 IF A$="P" THEN 1000
  245 IF A$="S" THEN 300
  250 GOTO 230
  300 REM
  301 REM ************
  302 REM OUTPUT TO SCREEN
  303 REM ************
  304 REM
  310 CN=PEEK(PO):CO=PEEK(PC)AND15
  320 POKE PC,1:POKE PO,42
  325 PRINT SP$
  330 PRINT CHR$(19);PO;PO-SS;CN;PC;CO;CHR$(19)
  340 JS=15-(PEEK(JY)AND15)
  345 TP=PO+JO(JS)
  350 IF TP<TL OR TP>BL OR JS=0 THEN 340
  360 POKE PC,CO:POKE PO,CN
  370 PO=TP:PC=PC+JO(JS)
  380 GOTO 310
 1000 REM
 1001 REM ************
 1002 REM OUTPUT TO PRINTER
 1003 REM ************
 1004 REM
 1010 PRINTSP$
 1020 OPEN4,4:CMD4
 1030 PRINT CHR$(16)"25SCREEN GRAPHICS DESIGNING AID"
 1040 PRINT CHR$(16)"32BY CRAIG HOWARTH"
 1050 PRINT:PRINT
 1060 PRINT "BORDER COLOR:";PEEK(BC)AND15
 1070 PRINT "SCREEN COLOR:";PEEK(SC)AND15
 1080 PRINT
 1090 PRINT "SCREEN LOCATION";
 1100 PRINT CHR$(16)"18OFFSET VALUE";
 1110 PRINT CHR$(16)"33CHARACTER CODE";
 1120 PRINT CHR$(16)"50COLOR LOCATION";
 1130 PRINT CHR$(16)"67COLOR CODE"
 1140 PR=TL
 1150 CN=PEEK(PR):CO=PEEK(PR+CD)AND15
 1153 POKE PR+CD,1:POKE PR,42
 1155 IF CN=32 OR CN=96 THEN 1205
 1160 PRINT CHR$(16)"05";PR;
 1170 PRINT CHR$(16)"21";PR-SS;
 1180 PRINT CHR$(16)"37";CN;
 1190 PRINT CHR$(16)"53";PR+CD;
 1200 PRINT CHR$(16)"70";CO
 1205 POKE PR+CD,CO:POKE PR,CN
 1210 PR=PR+1
 1220 IF PR>BL THEN 1999
 1230 GOTO 1150
 1999 PRINT#4:CLOSE4
```

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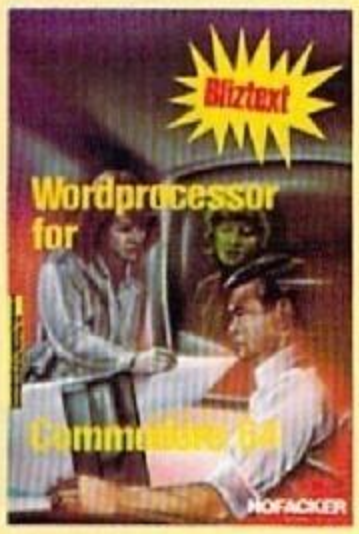

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Sprite Control

Get a firm grip on your sprites with this program that lets you manipulate them quickly and easily.

By M.J. Clifford

RUN It Right
Commodore 64

Address all author correspondence to M.J. Clifford, 2323 W. Bancroft St., Toledo, OH 43607.

There are many articles and programs for the Commodore 64 that deal with sprites. The purpose of most of these is to make it easy for you to design them. However, once you've designed the sprites, they still can be difficult to handle in Basic.

You must keep track of eight different pointer locations, eight y-coordinate registers and nine x-coordinate registers, as well as the various color and priority registers. The ninth x-coordinate register and the register that turns the sprites on and off require you to handle a single bit at a time. Bit manipulation requires that you know a little about binary numbering and the logical AND and OR operations. This can be a lot to handle even for the expert, never mind the novice.

Command Your Program

The program in Listing 1 adds to Basic four commands that take care of all these details. The commands turn sprites on or off, move them, automatically handle the problem of x being greater than 255 and put the pointers, colors, expansion and priority information into the proper registers.

The new commands are added to Basic by means of the SYS command, which transfers control to a machine language routine. The ML routine then reads the required values from the Basic program. Once the variable SP is set equal to 40080, the following commands are available:

Define a sprite: SYSSP,D,n,l,m,(c1, c2,)c3,xe,ye,p
Show a sprite: SYSSP,S,n
Hide a sprite: SYSSP,H,n
Move a sprite: SYSSP,M,n,x,y

Basic never sees the D, S, H and M subcommands, so you may use these letters elsewhere in the program. Of course, SP must not be changed from its value of 40080.

The lowercase letters, which may be constants, variables or expressions, represent the following.

n—sprite number 0–7
l—sprite data location 0–255 (13–15 are in the cassette buffer and 11 is unused memory below the screen). The actual memory address is 1*64
m—0 = monochrome, 1 = multicolor
c1,c2—the 01 and 11 colors shared by multicolor sprites (omit if m = 0)
c3—sprite color (10 colors for multicolor)

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```
5 REM SPRITE AID LOADER
6 REM M J CLIFFORD
7 REM 2323 W BANCROFT
8 REM TOLEDO OH 436Ø7
1Ø POKE52,156:POKE56,156:CLR
2Ø PRINT"{SHFT CLR}{5 CRSR DNs}{11 CRSR RTs}{CTRL 9} ON
   E MOMENT PLEASE "
3Ø AD=4ØØ8Ø
35 FORL=1TO19
4Ø FORX=ØTO15:READB:C=C+B:POKEAD+X,B:NEXT
5Ø READK:IFC<>KTHENPRINT"ERROR IN DATA IN LINE";1ØØØ+L:
   END
6Ø C=Ø:AD=AD+16:NEXTL
1ØØ PRINT"SPRITE AID PACKAGE IS LOADED"
11Ø PRINT"SAVING M.L. PROGRAM{CRSR DN}"
2ØØ F$="SPRITECD"
21Ø POKE187,PEEK(71):POKE188,PEEK(72)
22Ø FA=PEEK(187)+256*PEEK(188)
23Ø POKE183,PEEK(FA)
24Ø POKE187,PEEK(FA+1):POKE188,PEEK(FA+2)
25Ø POKE251,144:POKE252,156
26Ø POKE186,8:POKE185,1
27Ø POKE78Ø,251:POKE781,191:POKE782,157
28Ø SYS65496
3ØØ PRINT"SPRITE AID PACKAGE IS SAVED AS "F$
31Ø PRINT"{CRSR DN}NEXT TIME JUST ENTER:"
32Ø PRINT"LOAD"CHR$(34)F$CHR$(34)",8,1{2 CRSR DNs}"
1ØØØ REM *** SPRITE AID DATA ***
1ØØ1 DATA 32,115,Ø,2Ø1,77,24Ø,3Ø,2Ø1,83,24Ø,82,2Ø1,72,2
     4Ø,98,2Ø1,2113
1ØØ2 DATA 68,2Ø8,3,76,23,157,1Ø8,Ø,3,32,115,Ø,32,18Ø,15
     7,152,1314
1ØØ3 DATA 41,7,133,253,96,32,169,156,32,18Ø,157,132,251
     ,133,252,32,2Ø56
1ØØ4 DATA 18Ø,157,165,253,1Ø,17Ø,152,157,1,2Ø8,165,251,
     157,Ø,2Ø8,166,24ØØ
1ØØ5 DATA 253,232,169,Ø,56,42,2Ø2,2Ø8,252,164,252,2Ø8,9
     ,73,255,45,242Ø
1ØØ6 DATA 16,2Ø8,141,16,2Ø8,96,13,16,2Ø8,141,16,2Ø8,96,
     32,169,156,174Ø
1ØØ7 DATA 166,253,169,Ø,232,56,42,2Ø2,2Ø8,252,13,21,2Ø8
     ,141,21,2Ø8,2192
1ØØ8 DATA 96,32,169,156,166,253,169,Ø,232,56,42,2Ø2,2Ø8
     ,252,73,255,2361
1ØØ9 DATA 45,21,2Ø8,141,21,2Ø8,96,32,169,156,32,18Ø,157
     ,152,166,253,2Ø37
1Ø1Ø DATA 157,248,7,32,18Ø,157,166,253,232,56,169,Ø,42,
     2Ø2,2Ø8,252,2361
1Ø11 DATA 72,192;Ø,2Ø8,11,73,255,45,28,2Ø8,141,28,2Ø8,7
     6,88,157,179Ø
1Ø12 DATA 13,28,2Ø8,141,28,2Ø8,32,18Ø,157,152,41,15,141
     ,37,2Ø8,32,1621
1Ø13 DATA 18Ø,157,152,41,15,141,38,2Ø8,32,18Ø,157,152,4
     1,15,166,253,1928
1Ø14 DATA 157,39,2Ø8,1Ø4,133,253,32,18Ø,157,152,24Ø,1Ø,
     165,253,13,29,2125
1Ø15 DATA 2Ø8,141,29,2Ø8,2Ø8,1Ø,165,253,73,255,45,29,2Ø
     8,141,29,2Ø8,221Ø
1Ø16 DATA 32,18Ø,157,152,24Ø,1Ø,165,253,13,23,2Ø8,141,2
     3,2Ø8,2Ø8,1Ø,2Ø23
1Ø17 DATA 165,253,73,255,45,23,2Ø8,141,23,2Ø8,32,18Ø,15
     7,152,24Ø,9,2164
1Ø18 DATA 165,253,13,27,2Ø8,141,27,2Ø8,96,165,253,73,25
     5,45,27,2Ø8,2164
1Ø19 DATA 141,27,2Ø8,96,32,253,174,32,158,173,76,17Ø,17
     7,Ø,Ø,Ø,1717
```

Listing 1. Sprite Aid loader program.

Menu selection is done by means of a mouse that is much cuter than the one that rolls around on the table.

xe,ye—0 = normal, 1 = expand in x or y direction
p—priority 0 = sprite over text; 1 = text over sprite
x—x-coordinate 0–511 (24–343 are visible, others are all or partly off screen)
y—y-coordinate 0–255 (50–250 are visible).

The program in Listing 1 Pokes the machine language into memory and then saves it in a program file on disk.

Whenever you wish to use this program, you should load it by entering:

LOAD"SPRITECD",8,1 (,1,1 for tape)
POKE 52,156:POKE 56,156:NEW

Any program using these commands should begin with the following lines.

```
10 POKE 52,156:POKE 56,156:CLR
20 IF PEEK(40080)<>32 THEN LOAD
   "SPRITE CD",8,1
30 SP=40080
```

Listing 2 is a short demonstration of how you may use these commands. It also includes a method for menu selection by means of a mouse that is much cuter than the one that rolls around on the tabletop.

Description of Loader

10–30—Protect the machine language from Basic and set the beginning address.
35–60—Read the data from lines 1001–1019. The last number on each data line is a checksum. If you make a mistake in typing the data, the program will halt and report the line number of the data on which the error occurred.
100–110—report the successful loading of the package.
200–320—use the Kernal Save command to save the machine language in a program file that can be loaded directly with LOAD"SPRITECD",8,1 (,1,1 for cassette—also change the 8 in line 260 to a 1).

Description of Demonstration

5–20—Protect ML from Basic, load the ML if necessary, and set SP = 40080.
25—Puts data for a striped-box sprite in location 13.

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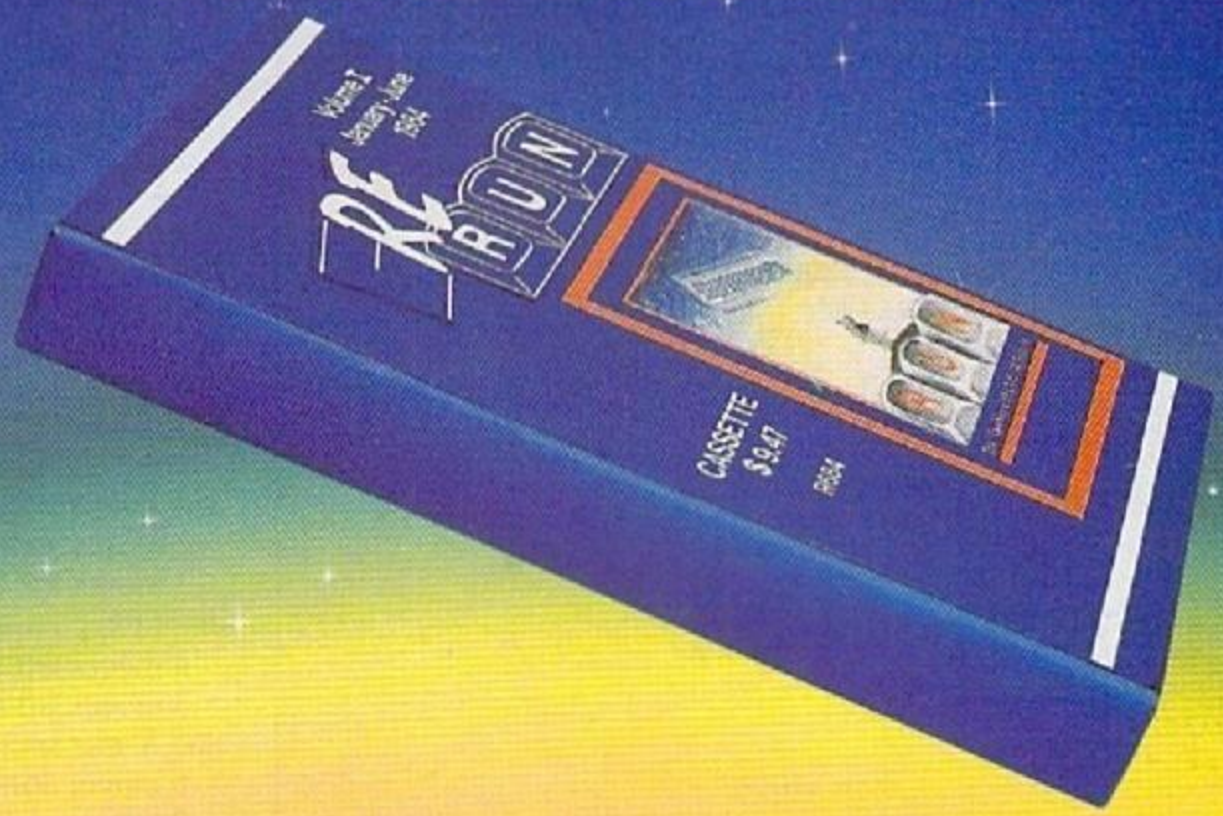

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Listing 2. Sprite Aid demonstration program.

```
1 REM SPRITE AID DEMO
2 REM M J CLIFFORD
3 REM 2323 W BANCROFT
4 REM TOLEDO OH 436Ø7
5 POKE52,156:POKE56,156:CLR
6 PRINT"{SHFT CLR}{5 CRSR DNs}{CTRL 9}LOADING M L PROGR
  AM {CTRL Ø}"
1Ø IFPEEK(4ØØ8Ø)<>32THENLOAD"SPRITECD",8,1
15 PRINT"{SHFT CLR}{5 CRSR DNs}{13 CRSR RTs}{CTRL 9} SP
   RITE{2 SPACEs}DEMO "
2Ø SP=4ØØ8Ø
25 FORQ=ØTO62:POKE13*64+Q,228:NEXT
27 FORQ=ØTO62:READB:POKE14*64+Q,B:NEXT
3Ø PRINT"{SHFT CLR}{COMD 8)":POKE53281,11:POKE5328Ø,12
32 REM ** MOVE MULTIPLE SPRITES
35 X=17Ø:Y=14Ø
4Ø FORZ=ØTO7
5Ø SYSSP,D,Z,13,1,1,7,Z,Ø,Ø,Ø
55 SYSSP,M,Z,X,Y:SYSSP,S,Z
6Ø NEXT
7Ø FORZ=ØTO14Ø
8Ø SYSSP,M,Ø,X+Z,Y:SYSSP,M,1,X+Z,Y-Z
9Ø SYSSP,M,2,X,Y-Z:SYSSP,M,3,X-Z,Y-Z
1ØØ SYSSP,M,4,X-Z,Y:SYSSP,M,5,X-Z,Y+Z
11Ø SYSSP,M,6,X,Y+Z:SYSSP,M,7,X+Z,Y+Z
12Ø NEXT
13Ø FORZ=ØTO7:SYSSP,H,Z:NEXT
14Ø SYSSP,M,2,Ø,Ø:SYSSP,S,2
15Ø FOR Z=1TO2ØØ:SYSSP,M,2,Z,Z:NEXT
16Ø SYSSP,H,2
169 REM ** EXPANSION AND COLOR CHANGE
```

More

27—Reads data from lines 1010–1025 for the mouse sprite and Pokes it to location 14.
30–120—Move 8 sprites at once.
40–60—Use a loop to define 8 sprites.
50—Defines sprite Z in location 13, multicolor, colors 1, 7 and Z, not expanded in either X or Y and having priority over text.
55—Moves sprite Z to position X,Y (170, 140) and shows sprite Z; only sprite 0 will be seen at first, since the other seven sprites are behind it.

70–120—Move all eight sprites away from the center, each in a different direction:

0 moves right as the X coordinate is increased by Z

1 moves right and up as X increases and Y decreases

2 moves up as Y decreases

3 moves left and up as both X and Y decrease

4 moves left as X decreases

5 moves left and down as X decreases and Y increases

6 moves down as Y increases

7 moves right and down as both X and Y increase

130—Hides all 8 sprites.

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140—Moves sprite 2 to the upper left corner and shows it.
150—Moves sprite 2 diagonally across the screen from upper left to lower center.
160—Hides sprite 2.
170–230—Demonstrate expansion and color changes.

170—Puts sprite 6 into the center of the screen and shows it.
180—Redefines sprite 6 in location 13 as monochrome with color Z and expanded width.
190,210,225—Unexpanded.
200—Expanded height.
220—Expanded in both height and width.

230—Does it again in three more colors, then hides it.
300–385—Use a mouse to make selections from a menu.
300—Defines sprite 0 as in location 14, monochrome, color 15, unexpanded and without priority over text.
310–340—Print a menu.
345—Sets Y coordinate of sprite according to the value of C.
350—Moves sprite to location 24,Y.
355—Waits for keypress.
360—If f3 is pressed, increases C.
365—If f1 is pressed, decreases C.
370—If the return key is not pressed, goes to 345.
385—If the return key is pressed, C is the value of the option chosen.
1000—Time-delay subroutine. [R]

Listing 2 continued.

```
17Ø SYSSP,M,6,17Ø,14Ø:SYSSP,S,6
175 FORZ=4TO7
18Ø SYSSP,D,6,13,Ø,Z,1,Ø,Ø:GOSUB1ØØØ
19Ø SYSSP,D,6,13,Ø,Z,Ø,Ø,Ø:GOSUB1ØØØ
2ØØ SYSSP,D,6,13,Ø,Z,Ø,1,Ø:GOSUB1ØØØ
21Ø SYSSP,D,6,13,Ø,Z,Ø,Ø,Ø:GOSUB1ØØØ
22Ø SYSSP,D,6,13,Ø,Z,1,1,Ø:GOSUB1ØØØ
225 SYSSP,D,6,13,Ø,Z,Ø,Ø,Ø:GOSUB1ØØØ
23Ø NEXT:SYSSP,H,6
299 REM ** MENU SELECTION BY 'MOUSE'
3ØØ SYSSP,D,Ø,14,Ø,15,Ø,Ø,1
31Ø POKE53281,11
32Ø PRINT"{SHFT CLR}{COMD 1}{CRSR DN}{17 CRSR RTs}{CTRL
    9} MENU {CTRL Ø}{2 CRSR DNs}"
33Ø FORP=1TO8:PRINT"{2 CRSR RTs}OPTION #"P"{CRSR DN}":N
   EXT
34Ø PRINT"USE F1 AND F3 TO MOVE THE MOUSE TO YOUR CHOIC
   E THEN HIT RETURN":C=1
345 Y=C*16+6Ø
35Ø SYSSP,M,Ø,24,Y:SYSSP,S,Ø
355 GETA$:IFA$=""THEN355
36Ø IFA$="{FUNCT 3}"THENC=C+1:IFC>8THENC=8:GOTO345
365 IFA$="{FUNCT 1}"THENC=C-1:IFC<1THENC=1:GOTO345
37Ø IFASC(A$)<>13THEN345
385 PRINT"{SHFT CLR}{5 CRSR DNs}YOU CHOSE OPTION";C:SYS
   SP,H,Ø
999 END
1ØØØ FORD=1TO2ØØ:NEXT:RETURN
1ØØ5 REM DATA FOR MOUSE IN LOCATION 14
1Ø1Ø DATA 3Ø,Ø,12Ø,63,Ø,252,127,129,254,127,129,254,127
     ,189,254,127
1Ø15 DATA 255,254,63,255,252,31,187,248,3,187,192,1,255
     ,128,3,189
1Ø2Ø DATA 192,1,231,128,1,255,Ø,Ø,255,254,Ø,127,248,Ø,2
     54,Ø
1Ø25 DATA 1,199,32,3,131,224,7,1,192,1,192,Ø,3,192,Ø,Ø
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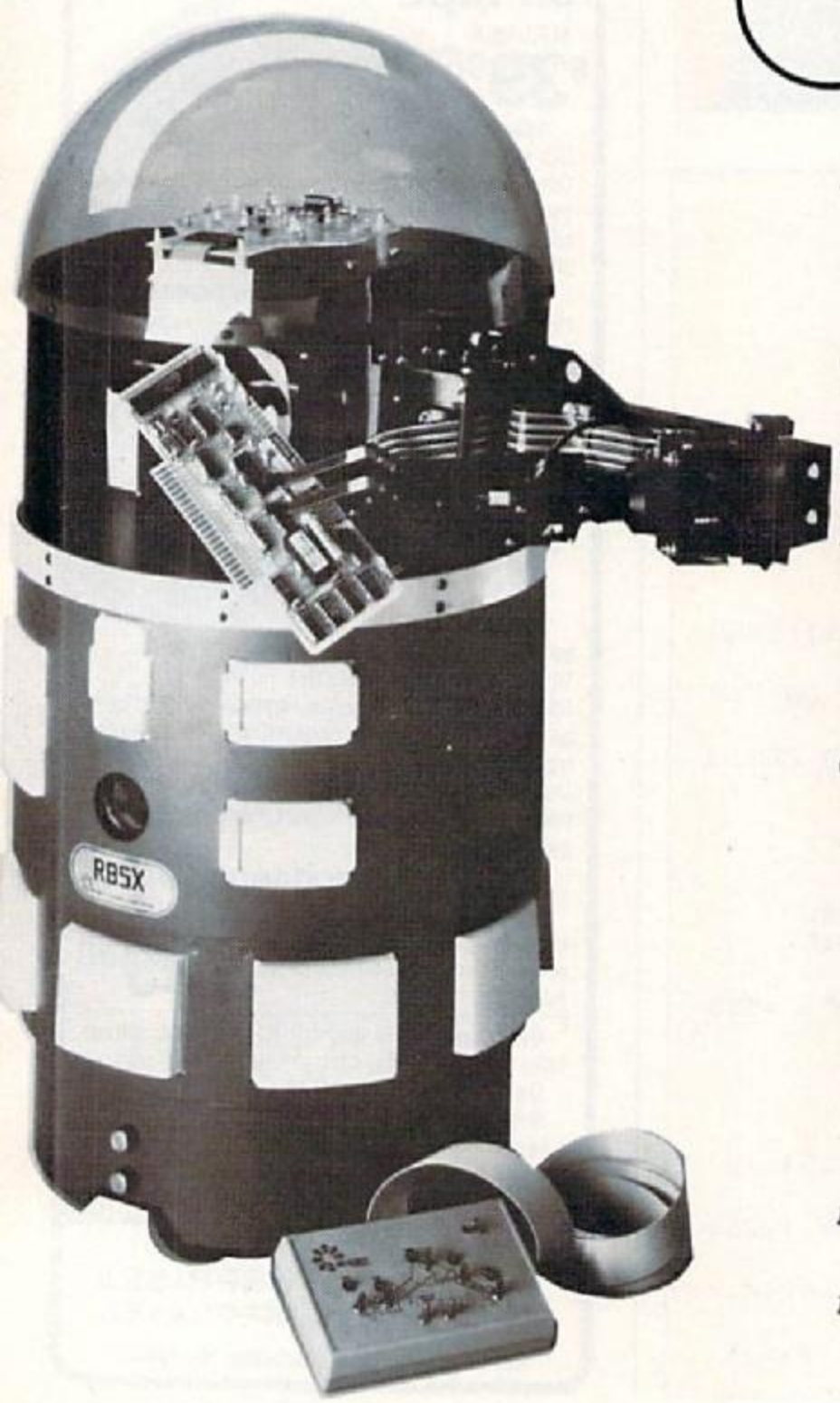
No need to become alarmed. Robots haven't taken over. . .yet. But the time is drawing near when personal robots may be as prevalent as, say, Commodore computers.

The ROBOTS Are Coming!

By Peggy Herrington



She heard the doorbell over the noise of the vacuum cleaner. Then that *hum was replaced by a low whirring sound.*

"Shall I see who's calling, Ma'am?" asked the robot as it wheeled into the room.

"Yes, do," she replied, not bothering to look up from her word processor.

The robot returned moments later. "It's Janie," it said, "asking if Pamela can play."

"Isn't it about time for her reading lesson?" she asked.

"Seventeen minutes until I am programmed to inquire about that," replied the robot.

"Ask Janie if she wants to join Pamela with your lesson when you're finished vacuuming."

"She will," the robot replied. "She always does."

"Very well."

The robot was whirring away when she called it back. "The Wilsons will be here this evening."

"For dinner or cocktails?" it asked.

"Both," she said.

"Thank you. I will report the bar inventory within ten minutes," said the robot.

"Remind me to load in your new joke program before they arrive and delay house security until they leave."

"Yes, Ma'am. Will that be all?" it asked.

"For now," she said, turning back to her Commodore 64.

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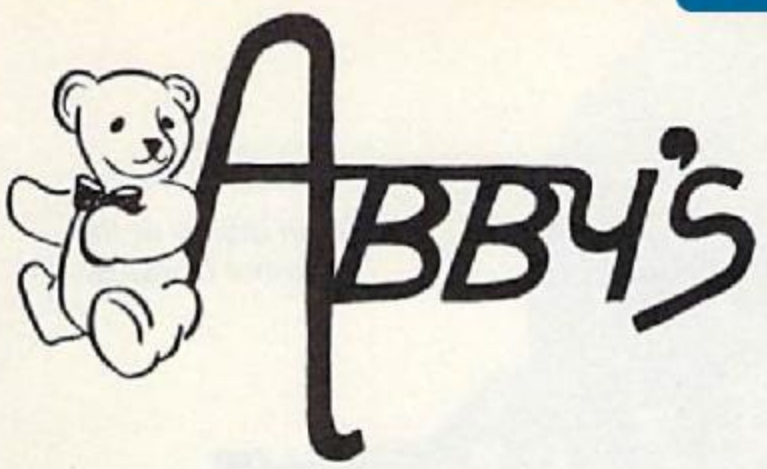

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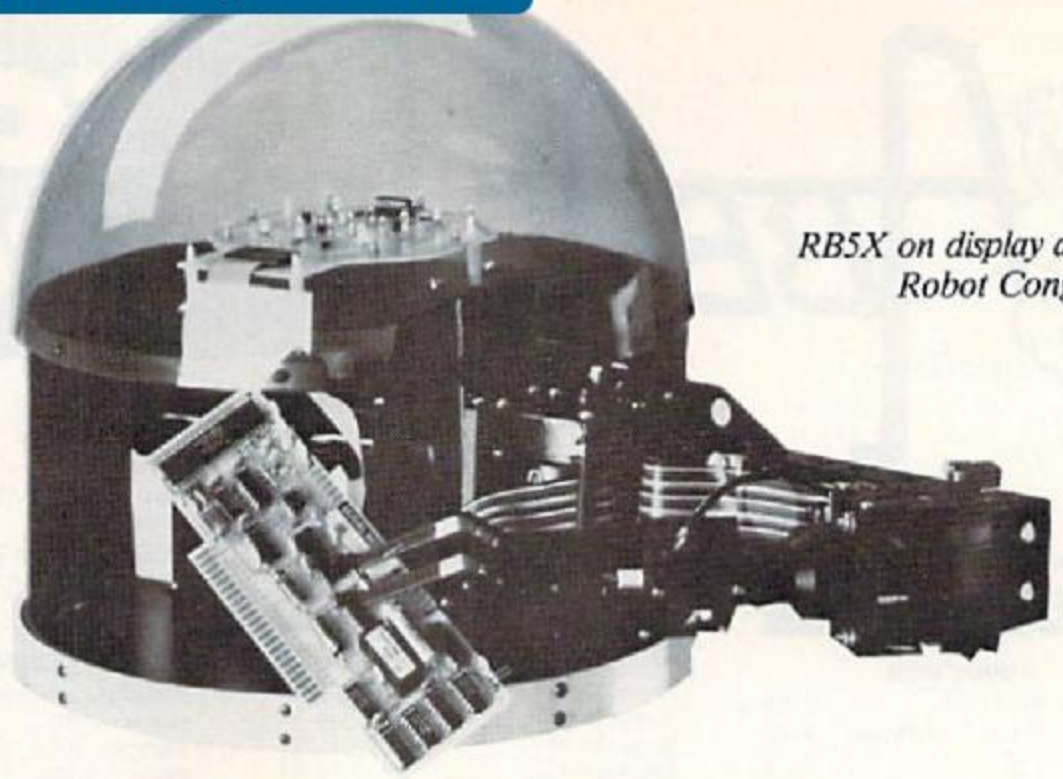

RB5X on display at the Robot Congress.

Hero can be programmed on the Commodore 64 (Photo by Eddie Johnson)

A robot answering the door, teaching kids, checking supplies, telling jokes and remembering guests' preferences, vacuuming and doing guard duty? What *is* this, a scene from a science fiction novel?

It is neither fiction nor fantasy. Today's personal robots have all these talents, and if they seem to lack the finesse demonstrated by this robot, it's only a matter of polishing some rough edges. The technology is available now, and many of those rough edges can be smoothed with computer programming.

A Gathering of "Personalities"

Hero, RB5X, B.O.B., Topo and a host of other personal robots—not industrial arms or metallic suits housing humanoids—walked and talked and blinked and beeped their way into Albuquerque, New Mexico, last April, for the first International Personal Robot Congress (IPRC). They and their developers bought news to the 3000 people who attended what promises to become an annual affair.

The future of personal robots is likened to that of personal computers a year or two ago. Indeed, this industry is counting on a robotics revolution on the scale of that brought about recently by personal computers. And personal computers are more than simply a parallel market.

All of the leading robotics firms announced at IPRC that their robots can now be programmed on the Commodore 64. This is good news for Commodore aficionados, but (and I wonder if they realize it) it's even better news for the robotics firms—in order to bring off this robotic revolution, they're going to need some help.

Whether you see the computer as a part of the robot or the robot as a peripheral to the computer depends upon your point of view. In his keynote address via satellite, Dr. Isaac Asimov, prolific science and science fiction author who referred to himself as "grandfather of the robot," called them "mobile computers."

Robots in general have internal processors, which carry out instructions sometimes based on information their sensors gather. This is how they walk, talk, remember and listen, carry small objects, avoid running into furniture and interact with humans.

Personal robotic technology is coming out of its infancy and not all of today's robots have the full range of these talents—not to mention that some robots (like computers) do things better than others.

Brent DeWitt, robot developer and author of *The Programmer's Tool Box* (a programmer's aid for RB5X), compared robot designers to parents in his speech in an IPRC seminar. "What a robot can *do* hasn't been as important as the fact that it's yours," he said. This attitude is changing, but whatever a robot does now or in the future will be programmed by a computer.

This is done by changing the Commodore 64 (and, in some applications, the VIC-20) into a dumb terminal with software similar to a word processor (so it won't "compute") and writing a program in a language understood by the robot. The program is then sent to the robot through an RS-232 interface.

Limited software is available at this writing (like computer software, it is not interchangeable between brands) and the need for third-party programming is great. Nolan Bushnell, president of Androbot and developer of the electronic game and the formation of Atari, believes "somewhere there's a pro-

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grammer out there now who will write the robotic version of VisiCalc."

RB5X

RB Robot Corporation, makers of the world's first mass-produced programmable robot, RB5X, will pay a 12% royalty for acceptable software for RB5X written in Tiny Basic, targeted toward adults or children. Of course, you'll need to get your hands on RB to write programs for it.

RB can be purchased at retail outlets around the country, and for "pre-selected, advanced program development" the company will make it available on loan. They mention other opportunities (for students, for example), so if you're interested, contact them for details.

RB is aimed at the top-of-the-market in robots with a retail price for the base unit of $2295. It's shiny, with an overall futuristic appearance. A transparent dome lets you view indicator lights flashing and some of its components as it performs its repertoire.

The on-board microprocessor, an INS 8073, works in conjunction with software to permit RB to learn from its sensory experiences. In other words, RB can progress from simple, random responses to more complex, predictive actions—it will, for instance, eventually find its way out of a corner. RB stands about three feet tall and has eight tactile sensors around its mid-section. These bumpers signal contact with other objects or you can press them to actuate programs.

Rechargeable batteries provide power (it can seek out its recharger and automatically plug itself in when power gets low) and it comes with 8K memory, which can be upgraded with a 16K option ($195). RB sees by means of a built-in Polaroid range finder sonar system so that it can navigate around obstacles.

Other RB options include a voice that can be programmed to speak or sing ($245). It's mobile, of course, by means of two independently driven wheels and a caster-support system that allow it to move and turn on its own radius on relatively smooth surfaces.

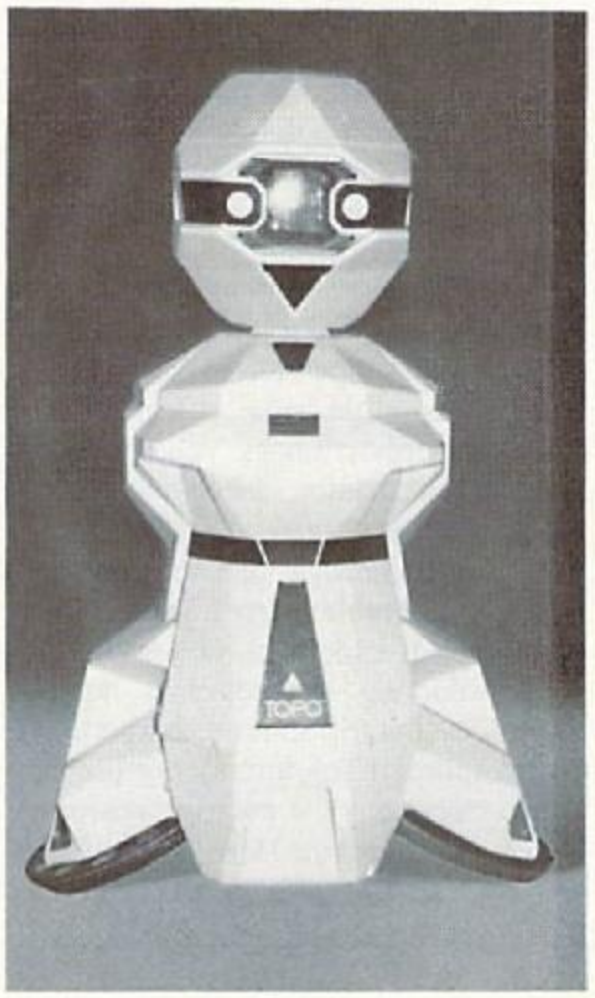
There's also an optional arm with gripper ($1495), which can lift, carry and release an object up to one pound in weight.

RB Corporation has announced that this fall a vacuum cleaner attachment will be available for RB5X. Operating with its own motor and batteries, it will attach to the lower skirt of RB and be adjustable for varying floor surfaces and carpet textures.

RB Corporation makes a Robot Appreciation Kit for $19.95. This is a three-ring notebook full of valuable information about robots in general (including reprints of magazine articles on the current technology), a paperback novel about robots by Isaac Asimov and a copy of the RB5X reference manual, less the technical appendices. If you're interested in finding out more about robots, this is a valuable resource. Should you end up buying RB5X, you can get full credit for this kit toward the purchase price. *(RB Robot Corp., 14618 W. Sixth Ave., Suite 201, Golden, CO 80401; 303-279-5525.)*

Hero I

If, however, you don't think you need the Cadillac of robots, for less



Topo is programmable with the Commodore 64. Kids seem to like its modernistic face. (Photo by Dale Rankin.)

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than the cost of RB5X' s optional arm/gripper alone, and some work, you can have a robot called Hero.

The Heath Company, manufacturers of electronic kits, called Heathkits, offers Hero I, complete but unassembled (with arm and voice) for $1200. Heath has a reputation for being innovative in the field of electronics; for instance, Heathkit computers were available long before home computers were popular.

Hero is an electronic hobbyist's delight. The documentation and instructions are extensive, and if you want to get to know a robot literally inside-and-out, this is the way to go. Hero is more utilitarian in appearance than RB5X, but this is more than offset by the hands-on opportunities you'll get for learning electronics, mechanics, computer theory and programming.

It takes somewhere between 40 to 80 hours to assemble Hero (depending on your level of expertise), and some previous soldering experience is helpful. There's even a top-mounted experimental breadboard for interfacing user-designed circuits to the microprocessor.

You *can* program Hero with a Commodore 64, but you don't need any computer; Hero is completely self-sufficient, since it contains a 6808 microprocessor. On Hero's "head" is a hexadecimal keyboard for entering instructions, and programs can be saved and reloaded by means of an ordinary audio cassette recorder, which connects to Hero's rear-panel serial cassette port.

It's equipped with light, sound and motion-sensing systems, plus a sonar range finder, all of which make it possible for Hero to see, talk and hear. It is powered by rechargeable batteries and maneuvers on three wheels, with a 12-inch turning radius. A detachable teaching pendant lets you manually control all motor and arm movements, and an optional detached keyboard allows remote control of the robot as well as the teaching pendant.

Speaking at an IPRC seminar, robotics consultant Tom Carroll, from Long Beach, California, who has built over 100 robots since 1957, called Hero "the ultimate learning tool."

For the less adventurous among us, Hero I is available completely assembled from Heath for $2200. *(Heath Company, Benton Harbor, MI 49022; 616-982-3678.)*

Androbot

B.O.B. and Topo are manufactured by Androbot, Inc. The company's name reflects its philosophy: a combination of android (which means an automaton with a human form) and, of course, robot. These robots look less like machines and more like people. They have heads with modernistic faces that seem to make them attractive to children. B.O.B. and Topo have the same off-white head and navigate by means of two angled-wheel assemblies, but differ vastly in most other respects.

B.O.B. (which means Brains On Board) is fully self-contained, with an 8088 microprocessor built in, capable of being expanded to a capacity of 640K. This provides it with a lot of artificial intelligence, programmable with the built-in keypad on its chest. As of this writing, it's compatible with IBM-PC and Apple computers only. (It may be able to run on the Commodore 64 at a later time.)

B.O.B. stands just under four feet tall and has ultrasonic and infrared sensors, which determine the range of objects around it. One of its best features is a Follow Me mode, which makes

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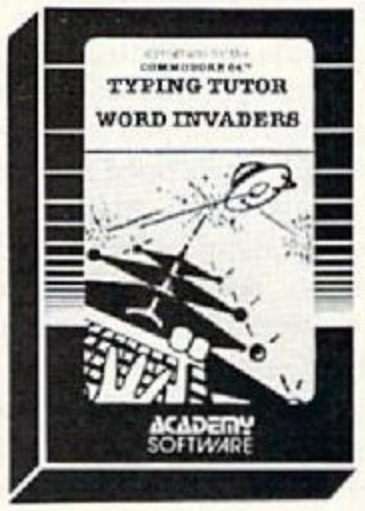

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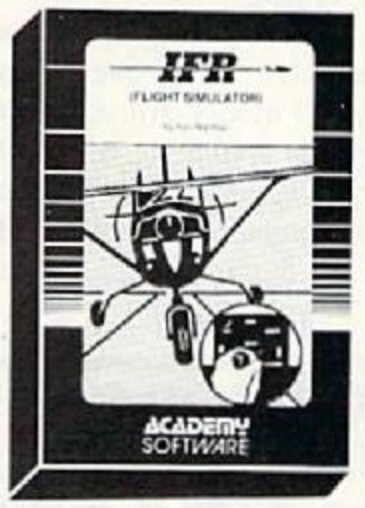

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teaching it to follow a path very easy—you walk and it follows. It will remember the route and repeat it by itself on command. Like Topo, it'll tell you when its batteries need recharging.

B.O.B. doesn't have arms with grippers in the sense of RB5X and Hero. It has an optional lift (retail $495) with a horseshoe-shaped "hand," which can raise and carry 18 to 24 pounds reliably. Its voice is quite understandable and it can sing. Equipped as I've described it, B.O.B.'s retail price is $3995. There's a model of B.O.B. available—of the base configuration only (wheels and drive but no accessories), appropriate for "engineering-level robotics experiments"— for $2495.

Topo is programmable on the Commodore 64 in Topo Basic (which comes with it) and will soon run on Logo. Androbot is in the midst of determining a structure for third-party software submissions. Contact the company if you're interested.

Topo is about three feet tall and can be taught to follow a path with a joystick. It has fold-down platforms for carrying small objects. With the optional AndroWagon (retail under $100), a waterproof, attachable wheeled wagon, it can pull up to 33 pounds. It speaks and sings in both program and direct Text-To-Speech mode; it retails for $1595.

An earlier version of Topo has been available for well over a year now. This original model enjoyed fewer of Topo's present capabilities, and Androbot is offering, upon return of the original robot and accessories in reasonable condition, a credit for the full retail price ($495) toward the purchase of the new Topo. Owners must supply proof-of-purchase and return Topo to an authorized Androbot dealer for exchange. *(Androbot, Inc., 101 E Daggett Drive, San Jose, CA; 408-BOB-TOPO.)*

Alternatives

Perhaps you're not ready to jump on the bandwagon of this developmental technology or you'd like to learn something about robotics without spending the family vacation fund. Several firms displayed robots at IPRC that were programmable on either the Commodore 64 or VIC-20.

Spectron Instrument Corp. demonstrated a line of educational and hobby robotic products, available in kits or assembled, ranging in price from $25 to several hundred dollars. They have two- and four-axis robotic arms, which can be programmed to draw or play games, and several other little devices that creep about freely. Their products are modular and can be upgraded (now or later) with visual and audio sensors. Contact the company for a catalog. *(Spectron Investment Corp., 1342 W Cedar Ave., Denver, CO 80223.)*

Androbot, Inc., offers a smaller desktop robot called F.R.E.D., which is programmable with its own separate keypad, meaning you don't need a computer at all. Equipped with drawing pens, it can do the full complement of Logo graphics. F.R.E.D., which looks like it's related to Topo and B.O.B. (and, of course, it is), can talk, draw and sense a void so that it doesn't fall off the table. It sells for under $400, complete.

New Tech Promotions offers a Turtle Tot Personal Robot for $399.95, plus $99.95 for a speech option. This, too, is a table-top or floor-model robot but it's housed completely inside a mobile transparent dome and is programmable with Logo. *(New Tech Promotions, 2265 Westwood Blvd., Suite 248, Los Angeles, CA 90024; 213-470-8383.)*

"Yes, but What Does It Do?"

It was fun to ask "the computer question" about robots at IPRC. Like computers, robots have so much potential that it's hard to put into words the fun, challenging, interesting—but not yet very practical—things they can do.

But personal robots are growing up. Like young of all kinds, the components are there, even if they're not fully developed; after all, babies walk before they run. Time, attention, financing and other resources are needed to bring them to maturity.

There are lots of ways to be a part of the predicted robot revolution, whether it's by enjoying a state-of-the-art robot like RB5X or B.O.B., building and learning from Hero, becoming "robot literate" with your kids and Topo or exploring hobby robotics on an educational level. If you have some programming experience, you might consider writing third-party software.

But don't wait too long—like the people who are still waiting for the perfect personal computer, you'll miss out on loads of fun waiting for the perfect personal robot. R

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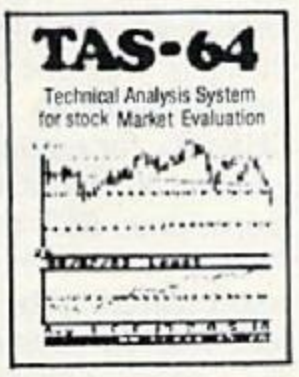

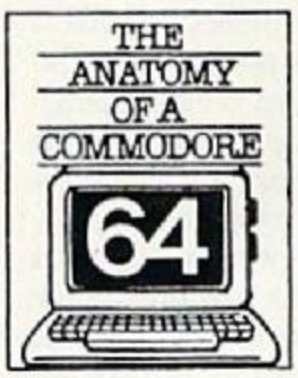

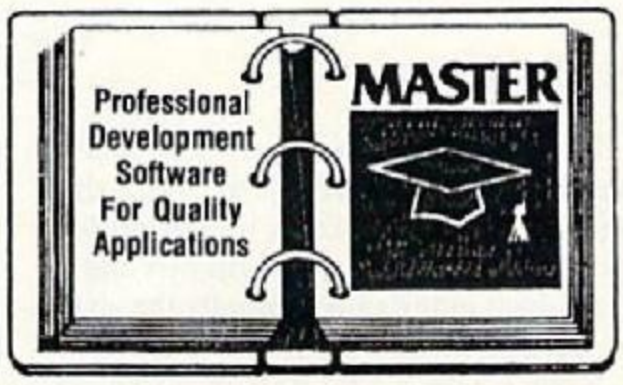

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Post a Notice

By W.G. Voight

Fig. 1. The basic 3- × 5-inch For Sale sign. (Reduced to 85% of actual size.)

Do you have something to say, something to sell or something to sing about? Turn your line into a sign and post it.

Not much has been written about bulletin board advertising, but this much is known: The cost is low and the technology is basic—a felt-tip pen and a 3- × 5-inch index card is usually the state of the art.

Since I have a VIC-20 with a Banana printer, I decided to whip up a program that would print an attractive sign, suitable for posting on the company bulletin board or at the local launderette. The resulting program is shown in the accompanying listing.

The size of the sign was chosen so as not to completely overpower the other advertisers with whom I'd be sharing space: A 3- × 5-inch border with all text printed in large characters and centered on each line. A typical sign is shown in Fig. 1. The basic sign has seven lines of up to 23 characters each, but this may be changed easily, as you'll see later.

The Banana printer has only two print sizes, so the expanded print size for five characters per inch (cpi) was chosen for the text portion of the sign. The border characters are printed in the normal character size, 10 cpi. A sign with a width of five inches will allow twenty-five characters per line at 5 cpi. Taken together, the two border characters at the ends of a line account for one expanded print position, since each is half the width of an expanded character. In addition, the program forces a minimum of one blank position at the end of a line. Therefore, the actual number of text characters is two less than the actual line length.

Line length is set by the variable LL in line 90 of the program. If you need a sign of a different width, changing the value of LL will adjust the number of characters in the line and will adjust the border to the new size. Fig. 2 shows a sign for a garage sale using five lines of 18 characters (LL = 20).

The vertical size of the sign is set by the variable NL in line 90. NL is the number of text lines. Each line of text is sandwiched between two lines, which are blank except for the border characters at each end. The printer is told to use Graphics mode (CHR$(8)) when doing line feeds, so that the border characters touch vertically.

The top border line is printed as a line of the character defined by B$, followed by three blank lines to provide a pleasing space above the text. The reverse is true at the bottom of the sign: three blank lines followed by the border character line.

How It Works

Lines 1 through 17 document the use of the variables in the program, and need not be entered as part of the finished product.

Lines 80 and 90 assign values to each of the variables. The assignment is done here so that it may be modified easily throughout the whole program by changing only one line. If your printer uses a graphics code other than CHR$(8), for example, you can change it in line 80, and it will be issued at the proper time. B$ is the border character. CHR$(191) was chosen for a checkerboard pattern. Any printable character code may be substituted here if you'd like a different border. NL and LL control the vertical and horizontal size of the sign as described earlier.

Lines 100–190 accept the text lines from the keyboard and assign them to the string variables AD$(LI), where LI represents the number of each of the text lines from 1 through the number assigned to NL. For example, AD$(4) contains the text that will be printed in the fourth line of the sign.

Lines 200–290 merge the border lines with the text lines vertically, and use the subroutines above line 1000 to format the lines horizontally.

Lines 1000 and 1010 print three blank lines above the first and below the last line of the text.

Lines 1400–1470 center the text on the print line and add the border character at either end. Then the line is printed.

Lines 2100–2130 assemble and print a line containing either a full line of the border character or a blank line with border characters at the ends.

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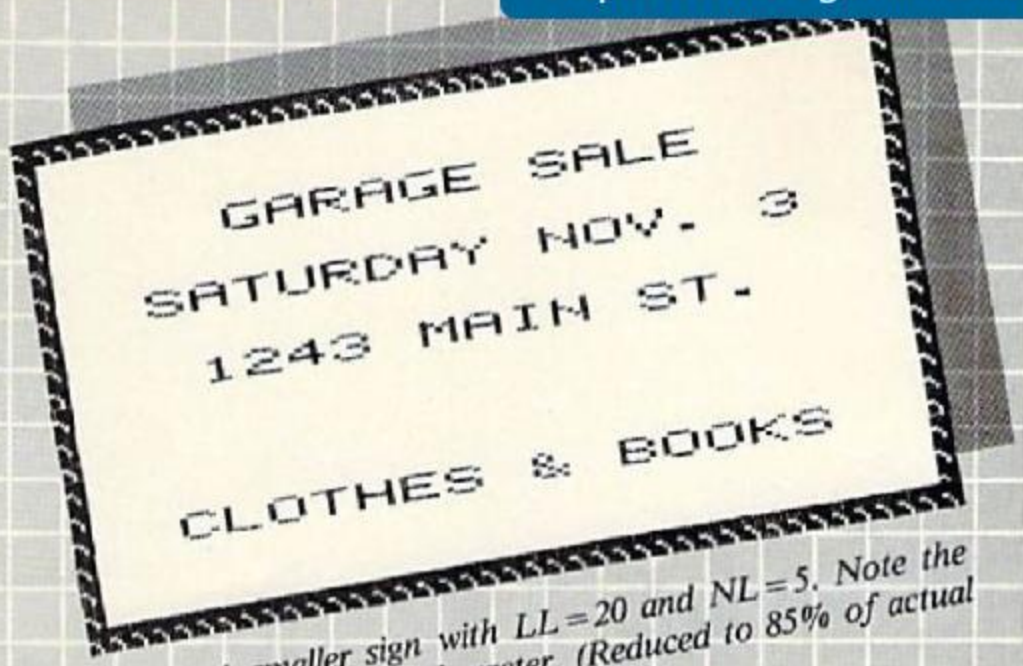

Fig. 2. A smaller sign with LL=20 and NL=5. Note the change in the border character. (Reduced to 85% of actual size.)

How to Use It

Enter the For Sale program into the computer from the Listing, omitting lines 1 through 17 if you wish. Type RUN.

The number of text lines and the maximum number of characters for each line will be shown at the top of the screen. As you enter each line, a question mark will appear at the left side of the screen, indicating that the program is ready for a new line. Do not add spaces at the beginning or end of the line, as the program will consider them part of the text and won't center the lines properly.

When you've entered the last line, the question mark will not appear, but the printer will begin making the sign. When you are finished, typing RUN will not reprint the same sign, but will restart the program from the beginning. If you'd like multiple copies of the sign, add the following two lines to the program.

```
270 INPUT"{SHFT CLEAR}ANOTHER
    COPY";CO$
280 IFLEFT$(CO$,1)="Y"GOTO220
```

A response of "Y" or "YES" will cause the same sign to be repeated when lines 270 and 280 are added to the basic program. If you use fan-fold paper, you may have to reposition it before answering the question in order to avoid printing over a perforation.

Of course, the program may be used for other things besides For Sale signs. Perhaps reward cards for classroom use or Keep Out signs for the children's bedroom doors would be good applications. You may not even have an application for this program, but it's worth experimenting with, anyway, if you're interested in Basic programming. R

```
1 REM:{7 SPACEs}GENERATES 3 INCH X 5 INCH
2 REM:{11 SPACEs}FOR SALE SIGN
3 REM:
4 REM:{5 SPACEs}A$ = STRING TO BE PRINTED
5 REM:{5 SPACEs}B$ = BORDER CHARACTER
6 REM:{5 SPACEs}C$ = CENTERED TEXT STRING
7 REM:{5 SPACEs}G$ = GRAPHICS COMMAND
8 REM:{5 SPACEs}N$ = NORMAL PRINT COMMAND
9 REM:{5 SPACEs}X$ = EXPANDED PRINT COMMAND
10 REM:{4 SPACEs}LI = CURRENT LINE #
11 REM:{4 SPACEs}LL = MAX LINE LENGTH
12 REM:{4 SPACEs}NL = # OF LINES
13 REM:{4 SPACEs}SL = STRING LENGTH
14 REM
15 REM
16 REM:{2 SPACEs}**********
17 REM:
80 X$=CHR$(14):G$=CHR$(8):N$=CHR$(15)
90 B$=CHR$(191):NL=7:LL=25
100 PRINT"{SHFT CLR}{5 SPACEs}-FOR SALE-{CRSR DN}"
110 PRINT" YOU HAVE ";NL;" LINES"
120 PRINT" OF ";LL-2;" CHARACTERS.{CRSR DN}"
130 FOR LI=1TONL
140 INPUT AD$(LI)
150 IF LEN(AD$(LI))<=LL-2 GOTO 190
160 POKE36878,15:POKE36876,200
170 PRINT" LINE TOO LONG : REDO"
180 POKE36878,0:GOTO140
190 NEXT LI
200 REM *** DO THE OUTPUT ***
210 OPEN1,4
220 R$=B$:GOSUB2100:R$=" ":GOSUB2100
230 GOSUB1000:FORLI=1TONL
240 GOSUB2100:GOSUB1400:GOSUB2100
250 NEXT LI
260 GOSUB1000:GOSUB2100:R$=B$:GOSUB2100
290 CLOSE1:END
1000 REM *** DRAW 3 BLANK LINES ***
1010 R$=" ":FORQ=1TO3:GOSUB2100:NEXTQ:RETURN
1400 REM *** ASSEMBLE AN OUTPUT LINE ***
1410 SL=LEN(AD$(LI))/2
1420 C$="":FORN=1TOINT(((LL-1)/2)-SL)
1430 C$=C$+" ":NEXTN:C$=C$+AD$(LI)
1440 FORN=0TO(LL-SL)/2:C$=C$+" ":NEXTN
1450 C$=LEFT$(C$,LL-1)
1460 A$=N$+B$+X$+C$+N$+B$+G$:PRINT#1,A$
1470 RETURN
2100 A$=N$+B$
2110 FORQ=1TO(2*LL)-2:A$=A$+R$:NEXTQ
2120 A$=A$+B$+G$:PRINT#1,A$
2130 RETURN
```

Listing of the For Sale program.

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PROGRAM GENERATORS

By Joseph Rotello, Jr.

Are you itching to create your own software, but can't because you don't have the necessary programming skills? Don't give up—put a program generator to work for you.

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INT POKE PRINT

For years after the introduction of Basic as a programming language and the appearance of microcomputers, users had to choose between two methods of acquiring software programs. Either they had to settle for existing software available "off the shelf," or they had to program their own.

Pre-made programs often proved inadequate to the need or simply didn't work, and since most users weren't—and still aren't—programmers, self-generated software was seldom possible.

Now, however, the situation has changed. There are hundreds of good, reliable software products available for your trusty C-64 and that nifty disk drive and printer. But a problem still remains. How many months will it take you to sample even ten or 15 of them? And if you buy one or two that *sound* like what you want, will they really meet your particular needs?

Wouldn't it be nice, you think, if you could buy a ready-made program that would create just the programs you want for your special purposes? Well, you no longer have to entertain futile dreams. Programs that write other programs now exist; moreover, they work well, can be mastered by everyday users and are cost-effective.

To the Rescue!

Program generators (PGs) are not a new phenomenon. They have been around for a long time in the world of mainframe and minicomputers. The main reason they were slow in appearing for microcomputers was that the memory they occupied left little storage room in which to create the desired new program. This limitation has been overcome with the development of micros, like the C-64, with greatly expanded memory capacity.

Microcomputer PGs have evolved into clear, concise, user-friendly programs that take advantage of the in-

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herent speed and data-manipulation power of the small computer. The overall characteristics of most PGs can be generally stated as follows:

1. You, the user, do indeed create the program, but the PG dictates the precise form and overall structure of the Basic code that will eventually be generated.
2. Your program is built up via screen menus that extract from you the information about the proposed program's title, content and basic form. This occurs through a variety of detailed question-and-answer sessions.
3. The PG eventually outputs a working Basic program to a disk drive for storage. The resulting program is now a "stand alone." The PG is no longer needed to load and run the new program.

Most of the available PGs share similar basic procedure structures, but internal methods vary. For example, some PG programs are themselves mostly or entirely in machine language. Others are coded in Basic.

Those coded in machine language cannot be listed to the screen or printer, nor can they be modified except by qualified machine language programmers.

PGs coded in Basic may be somewhat slower than those in machine language, but the Basic PGs I've examined don't show any really objectionable increase in execution times over comparable machine language programs.

Whether in machine language or Basic, the PG program code may be composed of many discrete sub-programs, each one charged with producing a likewise discrete, but eventually interwoven, Basic program component.

For example, one PG sub-program section may deal exclusively with program layout and flowchart preparation, another with generating menus or other information displays. Another section might deal with disk structure and data input/output code. Still another may delve into the printer needs and required report-generating procedures.

You can see that the secret of producing a coherent Basic program with a PG lies in its ability to successfully combine bits and pieces of Basic program logic into one program. In many respects, the PG will essentially follow the same procedures any good programmer would employ when creating a Basic program from scratch.

Product Overview

No discussion of program generators would be complete without at least a cursory inspection of some of the PG products currently available for the Commodore 64. The following represent the PG software providers who responded to our program-for-review request.

Programs For the Home

Dynatech also features a program generator for home applications. Home FileWriter is part of the same family of software as CodeWriter. With this program, there is no need to know computer programming to write unique programs for the home.

Just set up your screen and calculations in plain English. Your C-64 will translate your instructions and draw up the code that the computer will accept.

This program generator will let you handle such home applications as maintaining inventories of household items, mailing lists, tax information, check balancing, medical records and credit card information.

Home FileWriter is available on disk for $69.95 from Dynatech.

CodeWriter

CodeWriter (Dynatech Microsoftware, 7847 N. Caldwell Ave., Niles, IL 60648; $99.95) is one of the more simple-to-use PGs I have seen. The program seems best suited to the entry-level computer user, although more advanced programmers will find it powerful enough for many applications.

The program manual is excellently written and very easy to comprehend even for the computer novice. The only drawback to the manual is that only one detailed example of PG use is given. This single example, however, is very well detailed in just about every respect.

The test version came equipped with tutorials on disk that were comprehensive and clear. They also described another sample program to help you understand CodeWriter's program operation. A more definitive manual is in the works and should be available soon.

CodeWriter is itself programmed mostly in Basic, although there seem to be internal references to a few computer-specific operating system routines. CodeWriter's overall execution speed is generally acceptable for most applications.

In my test usage, I found CodeWriter to be pleasant to use. The program does not presume that you understand anything more complicated than how to answer specific questions presented via screen menus.

Although it's impossible to estimate fairly CodeWriter's programming efficiency, I noted that to duplicate an already existing, fairly complex inventory program took about 55 minutes versus the estimated 15 hours the hand-coded version required.

The Last One

The Last One (Computer Marketing Services, 26 Springdale Road, Cherry Hill, NJ 08003; $99.95) has been available in Great Britain for over two years, initially for the Commodore PET/CBM computers. It is the more thorough and internally complex of the two program generators reviewed here in that it provides a more complete treatment of programming introduction, data files, sorting and report generation, both in the manual and in the actual program.

Most first-time users will not find the manual hard to comprehend, even where more complex programming topics are discussed. As with CodeWriter, a new, more spacious manual is being prepared and should be available by the time you read this article.

The Last One appears well suited to most areas of programming, and advanced programmers should find it powerful enough for just about any of their needs. It is itself programmed mostly in machine language, although there seem to be a few internal program references to Basic where the use of Basic is preferred. The overall program-execution speed is acceptable for any user application.

One interesting feature is the extensive use of flowcharting. The Last One uses a modern "English language" flowchart, with entries that are numbered lines briefly describing the logic to be performed at that point in the program.

Once understood, this method grows on you. In fact, by using this interesting flowchart, the Last One is actually introducing you to an excellent programming principle: Plan your program before you start it!

Epilogue

One thing can't be mentioned often enough. Due to the value of the program generators, always precede initial

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program use by performing three very important steps:

1) Read the manual at least once before attempting to use the program.
2) Be sure to make secure backup copies of all disks provided with the program.
3) Return any registration cards promptly, so that any future information or program updates can be sent to you.

Strict adherence to these simple rules will save many hours of frustration in the long run.

The key to effective operation of a program generator is not to jump directly into it with the expectation of writing the ultimate program. When you receive the software, take the time to experiment and begin slowly, so that you can get into the flow, so to speak.

The best way to approach a PG is like you would a new car. Familiarize yourself with all the pedals and controls, and you'll enjoy the new machine sooner. Work your way into the possibilities of your PG, and you'll discover a new and satisfying dimension of your personal computer. R

Master 64

by Jim Strasma

Master 64 (for the C-64; 1541-compatible disk required; Abacus Software, PO Box 7211, Grand Rapids, MI 49510; $84.95) takes a different approach to application generation than either a conventional data manager program or the other two programs reviewed here. Instead of leading you through the design of a file or Basic file-handling program, Master adds 100 new commands to Basic that greatly ease the design of a file-handler and other serious programs.

These commands fall into the categories of drawing, data entry, screen management, report formatting, file management, extended precision math, a programmer's aid package, Basic 4.0 and a simple machine language monitor. Also included are several other utility programs.

The first thing you notice when trying to use Master is that you have to refer constantly to the manual if you more than double the number of Basic commands. Fortunately, the large manual is well set up for reference, with most commands on separate pages, and everything needed to use the command on the same page. On the other hand, nothing in the manual qualifies as a tutorial, and one is badly needed.

Fortunately, there are two very impressive demo programs on the Master disk; after I listed them to a printer, I was able to copy some of their techniques into my own application. Too bad they weren't listed in the manual.

What first impressed me about Master was its Data-Entry commands. They completely overcome all the limitations of Basic's Input and Get commands, allowing you to specify any kind of input you want and to enter it from any desired spot on the screen.

In less than an hour, a skilled Basic programmer can design a data-entry screen that fully conforms to Commodore's recommended standards and is completely foolproof in use. It can even include separate Help screens loaded from disk or transferred from extra screen pages in memory.

The same flexibility applies to work with the printer. By first sending reports to a relative disk file and then to a printer, Master makes it possible to arrange information on a printed page as easily as on the screen. Simply specify the row, column, length and contents of each data item.

File handling is a bit more complicated. A separate program must be run in order to create a new data file, although doing so can be automated within a Master program. The files themselves use ISAM (Indexed Sequential Access Method) for speed.

Like relative files, ISAM allows rapid access to any record within the file. However, there are some hitches; you can't validate (collect) a disk that contains a Master data file, or you'll lose it. Also, space on the disk will only be used efficiently by the file if your chosen record size divides closely into 254. Further, deleted records still use up space on the disk until the file is copied by a separate program.

On the other hand, using commands included in Master, you can greatly compress the size of file data. For instance, you can automatically verify and store a date in only two bytes, and numbers up to 127 in one.

One of my other favorite features is Master's 22-digit precision math. This is essential for many business applications, and I've not found it in any other product.

As you work, you'll also have the usual programmer's aid commands available (trace, renumber, auto, etc.), along with a full set of Basic 4.0 disk commands and a simple machine language monitor. On the other hand, don't expect to use other programmer's aid programs or cartridges at the same time. Master works well with a transparent IEEE-488 interface, such as the Bus Card, and any connected CBM disk drive, but does not claim to work with anything else you might plug in.

Unfortunately, Master's many features take a heavy toll in memory. Instead of the usual 38K free, you'll have just 20K for your programs. Admittedly, programs will be shorter than usual, because Master's commands do so much of the hard work, but you will still have trouble using it for very large applications.

On the other hand, if your planned application will fit in the memory available, Master will greatly ease your work in developing programs, and you may freely sell your finished program without paying any royalty for using the run-time version of Master that is included. If you would like to protect that program from unauthorized listing and use, Abacus will also sell you a set of dongles that will limit program access to those who have them.

Master is more likely to be useful to a trained programmer than a new user, due to the amount of pre-planning needed to get a viable program out of it. I like Master a lot, but don't use it as often as I'd expected, largely due to its size. On the other hand, in the proper application, nothing else currently available controls your screen and printer more completely or precisely, and the price is reasonable compared to that of other programmer's aids. R

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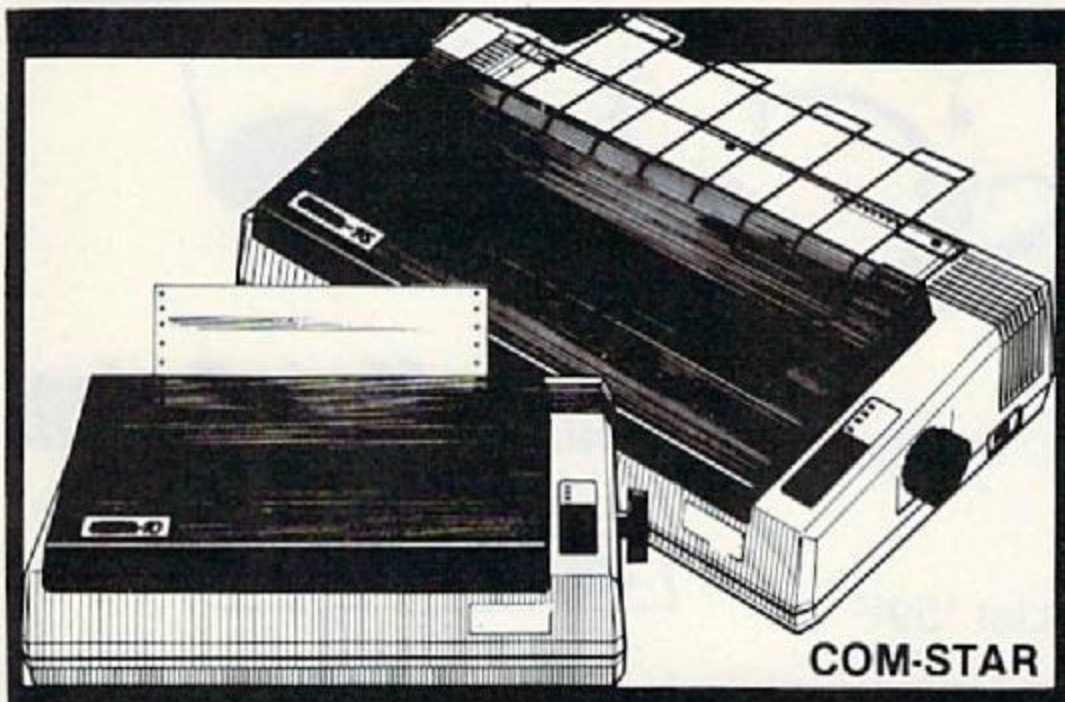

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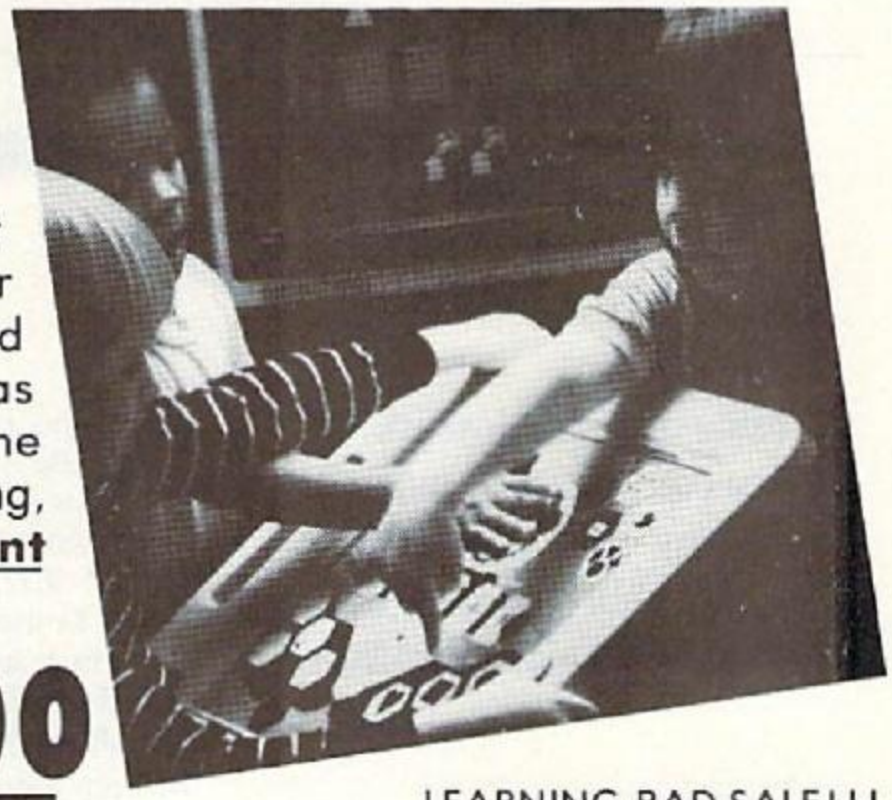

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Sound Off

With Your Joystick

Using only your joystick, you can set your C-64 humming and ringing with this program, which takes full advantage of the Commodore's sound capabilities.

By Larry Cotton

There's no reason why you should limit the use of joysticks to moving rocket ships and firing barrages at invading aliens. Joystick data registers 56320 and 56321, when Peeked at and read, can be used to control auditory as well as visual images. This program illustrates how you can control sounds by using only the joystick.

To keep the program short and simple, only one main voice is used—but you'll be amazed at the C-64 sound capability. You can certainly add more voices, but if you're programming in Basic, there will most likely be an unacceptable decrease in speed of pitch changes and reaction to joystick movements.

To achieve the greatest variety of sounds with the least amount of typing, I exploited two interesting characteristics of the 64: the superimposition of one waveform on another and the combining of sync and ring modulation with the triangle waveform.

Sounding Good

The first characteristic means this: A sound in the triangle, sawtooth, square or noise waveforms is normally a constant, unvarying sound, but when one of these four waveforms "rides," or is superimposed on another, nice things happen.

You can best understand the second characteristic by hearing it rather than having it described to you. Suffice it to say, however, that sync and ring modulation are normally used *separately* with the triangle waveform, but you can accomplish the most unusual sounds by combining them: Poking a 23—16 (triangle) + 4 (ring) + 2 (sync) + 1 (gate)—to a control register (54276 for voice 1) does this.

Look at Fig. 1: Under column 1 are the normal "pictures" of triangle, sawtooth, square and noise waveforms. You may hear these by Poking a 17, 33, 65 or 129, respectively, to memory location 54276 for voice 1. But now you do

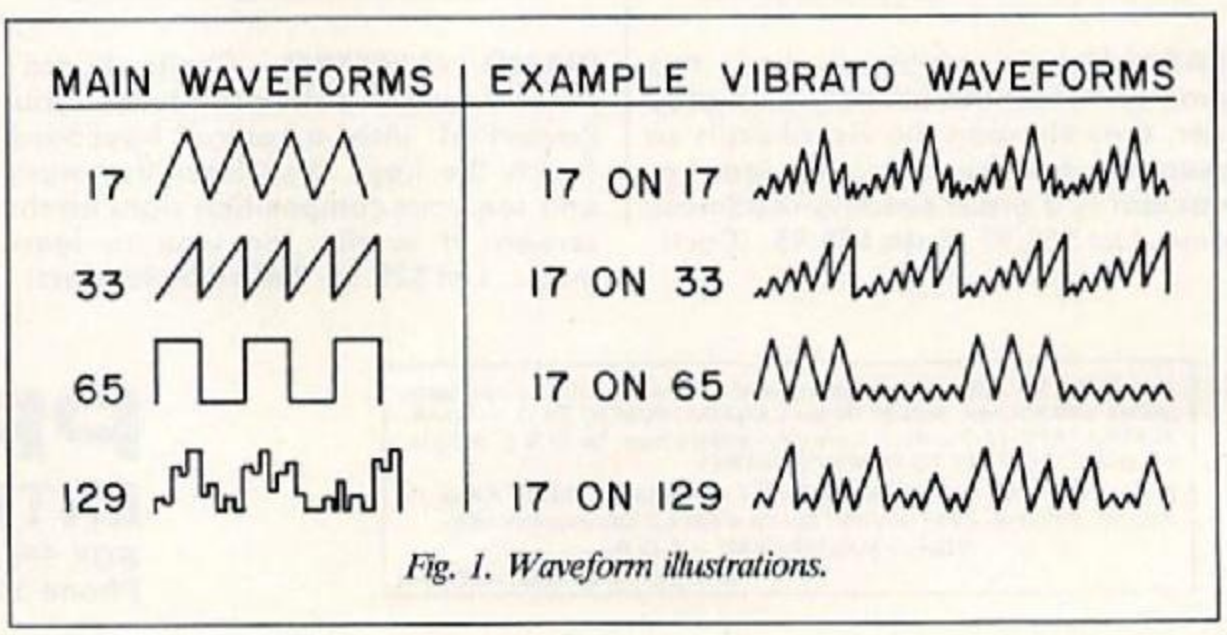

Fig. 1. Waveform illustrations.

RUN It Right

Commodore 64

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```
10 PRINTCHR$(147)
20 FORT=1TO6:PRINT:NEXT
30 PRINT"{15 SPACEs}RANDOM {SHFT *}{SHFT Q}
35 PRINT
40 PRINT"{5 SPACEs}{SHFT M}{8 SPACEs}{SHFT N}{5 SPACEs}
   {SHFT B}
50 PRINT"{6 SPACEs}{SHFT Q}{6 SPACEs}{SHFT Q}{6 SPACEs}
   {SHFT Q}{5 SPACEs}{SHFT Q}{SHFT *}{3 SPACEs}FIRE
60 PRINT"{7 SPACEs}{SHFT M}{4 SPACEs}{SHFT N}{7 SPACEs}
   {SHFT B}
70 PRINT"
80 PRINT"{4 SPACEs}PITCH{2 SPACEs}DEPTH{2 SPACEs}SPEED{
   2 SPACEs}MAIN{2 SPACEs}VIBE
90 PRINT
100 FORL=54272TO54295:POKEL,0:NEXT
110 P=54299:V=54273
115 POKE54294,50:POKE54287,5
120 POKE54275,8:REM FOR USE W/65V1
130 POKE54289,8:REM FOR USE W/65V3
140 POKE54277,4:POKE54278,89
150 POKE54296,143:REM V3 AUDIO OFF
160 Q=2
170 R=200:REM PITCH
180 S=50:REM SPEED
190 T=65:REM VIB WAVE
200 U=33:REM MAIN WAVE
210 IFR<0THENR=0
212 IFS<0THENS=0
213 IFS>255THENS=255
214 IFU<1THENU=1
215 IFU>255THENU=255
216 PRINTTAB(4)R"{CRSR LF}{2 SPACEs}"TAB(12)INT(Q*10)"{
    CRSR LF}{2 SPACEs}"TAB(19)S"{CRSR LF}{2 SPACEs}";
218 PRINTTAB(25)U"{CRSR LF}{2 SPACEs}"TAB(31)T"{CRSR LF
    }{2 SPACEs}{CRSR UP}"
220 POKE54286,S:REM SPEED OF VIBRATO
230 POKE54290,T:REM VIBRATO WAVEFORM
240 POKE54276,U:REM MAIN WAVEFORM
250 FORZ=1TO1000:W=INT((R+PEEK(P)*Q)/20)
255 IFW>255THENW=255
256 IFW<1THENW=1
260 POKEV,W
270 J=PEEK(56320)
280 IFJ=127THENNEXT
290 IFJ=126THENS=S+2:GOTO210:REM UP
300 IFJ=125THENS=S-2:GOTO210:REM DOWN
310 IFJ=111THENGOSUB500:GOTO210
320 IFJ=119THENGOSUB600:GOTO210
330 IFJ=117THENR=R-50:GOTO210
340 IFJ=122THENR=R+50:GOTO210
350 IFJ=118THENQ=Q+.3:GOTO210
360 IFJ=121THENQ=Q-.3:GOTO210
370 IFJ=123THENR=INT(1000*RND(1))+1:S=INT(250*RND(1))+1
    :Q=INT(10*RND(1))+.1
380 IFJ=123THENI=INT(5*RND(1))+1:K=INT(4*RND(1))+1
390 ONIGOSUB1000,1005,1010,1015
400 ONKGOSUB2000,2005,2010,2015,2020
410 GOTO210
500 IFT=17THENT=33:RETURN
510 IFT=33THENT=65:RETURN
520 IFT=65THENT=129:RETURN
530 IFT=129THENT=17:RETURN
600 IFU=17THENU=33:RETURN
610 IFU=33THENU=65:RETURN
620 IFU=65THENU=129:RETURN
630 IFU=129THENU=23:RETURN
640 IFU=23THENU=17:RETURN
1000 T=17:RETURN
1005 T=33:RETURN
1010 T=65:RETURN
1015 T=129:RETURN
2000 U=17:RETURN
2005 U=33:RETURN
2010 U=65:RETURN
2015 U=129:RETURN
2020 U=23:RETURN
```

Listing of Soundstick program.

three additional things: Poke one of these same values into voice 3 control register 54290; add a Peeked value from 54299 to voice 1's frequency; and turn off normal voice 3 audio by Poking a 143 into 54296.

Poking a waveform (17, 33, 65 or 129) to 54276 and 54290 would normally just turn on those voices (assuming envelope, frequency and so on are set), but when a value of 0 to 255, from register 54299, is added to voice 1's frequency, voice 1's pitch is controlled by the shape of voice 3's waveform!

If you could take pictures of the resultant *vibrato* waveforms, they would look somewhat like the illustrations in column 2. For example, the characteristic mellow sound of the triangle wave could change in a triangle fashion—

All other combinations of the waveforms are possible simply by appropriate movements of the joystick and firebutton.

smoothly uphill, as values from 54299 increment from 0 to 255, then smoothly downhill, as values from 54299 decrement from 255 to 0.

When voice 1's sawtooth waveform is superimposed over voice 3's square wave, you'll hear alternating high and low pitches as the sawtooth waves play out of the plateau, then abruptly drop to the plain and play there. The value at 54299 alternates from 255 to 0, then back to 255, with no steps. This is the first sound you hear in the program.

When the main waveform is noise (129), you'll hear noise, all right, but when the vibrato waveform (voice 3) is noise, you'll hear a series of randomly pitched tones, or randomly pitched noises. Last but not least, Poking a 23 to voice 1's control register yields the unearthly sounds of the sync and ring modulation combined with the triangle. All other combinations are possible simply by appropriate movements of the joystick and fire button.

About the Program

Plug a joystick into the port (socket) closest to the power switch. Type in the program, save and verify it, then type RUN. After turning up the TV or moni-

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tor's volume (a hi-fi's even better), the sound you'll hear before moving the joystick or pressing the fire button is a sawtooth wave riding, at a moderate speed, on a square wave. Now move the joystick or press the firebutton to observe what happens. Note that the pictures on the screen show you which way to press the stick for various effects.

To change voices or pick random sounds, quickly tap the joystick to the right or left, or tap the firebutton and release it immediately. If you hold them too long, the voices will go through one more change.

Lines 10–90 format the screen. Lines 100–150 clear and Poke values to the sound chip as follows: Line 115 Pokes a frequency into voice 3 and a cutoff frequency to the filter; lines 120 and 130 Poke 8s to the pulse-width registers of voices 1 and 3. This ensures that the main square wave will have a nice hollow sound, and that voice 3's square wave will cause voice 1's pitch to sound the same amount of time up and down.

To change the ratio of up-time and down-time (high to low pitch), try Poking 1 to 15 into memory location 54289. Lines 140 and 150 set a constant volume envelope for voice 1 and Poke a 143 (15 for maximum volume + bit 7 on, voice 3 audio off) into 54296.

Lines 160–215 assign, and check for the legality of, values for variables that will later be Poked to the sound chip. (Note that Q and R don't get Poked directly; see line 250.)

Lines 216 and 218 print variable status to the screen. Lines 220–240 Poke the changing variables to the sound chip—two waveforms (main at 54276 and vibrato at 54290) and speed (the frequency of voice 3 at 54286).

Lines 250–280 form a 1000-cycle loop if the joystick or fire button are *not* touched. For each cycle, a new frequency, W, is generated and Poked into one of voice 1's frequency registers. (The other, 54272, always stays at zero.)

Meanwhile, the joystick register 56320 is continually being Peeked at. W is based on two values controlled by the joystick—pitch R (with the joystick diagonal one way) and depth Q (with the joystick diagonal the other way), plus the value Peeked from register 54299, factored by a constant. If J stays at 127 (with all the joystick switches open), the program loops back to line 250 and the interesting vibrato effect continues.

Lines 280–380 check the status of the joystick and fire button. Note the simple way of detecting whether the fire button or stick is pushed, and which way. Also note the REM statements to show you what's happening.

Lines 370–400 provide for a random sound to be picked by the computer when you press the stick momentarily to the left.

Lines 500–530 and 600–640 are subroutines that cycle through the waveforms when you push the fire button or move the joystick to the right. Lines 1000–1015 and 2000–2020 are subroutines that are called by the random-choice GOSUB statements in lines 390 and 400.

Be sure to keep a close eye on the changing values as you move the joystick or press the fire button, and write down the sounds you like best so you can repeat them. Interesting settings are, in order of appearance on the screen: 420, 20, 184, 33, 33 or 600, 80, 150, 23, 17 or 700, 50, 150, 23, 33 or 100, 60, 10, 129 and 17. Feel free to experiment and stick a little joy into your sound programs. R

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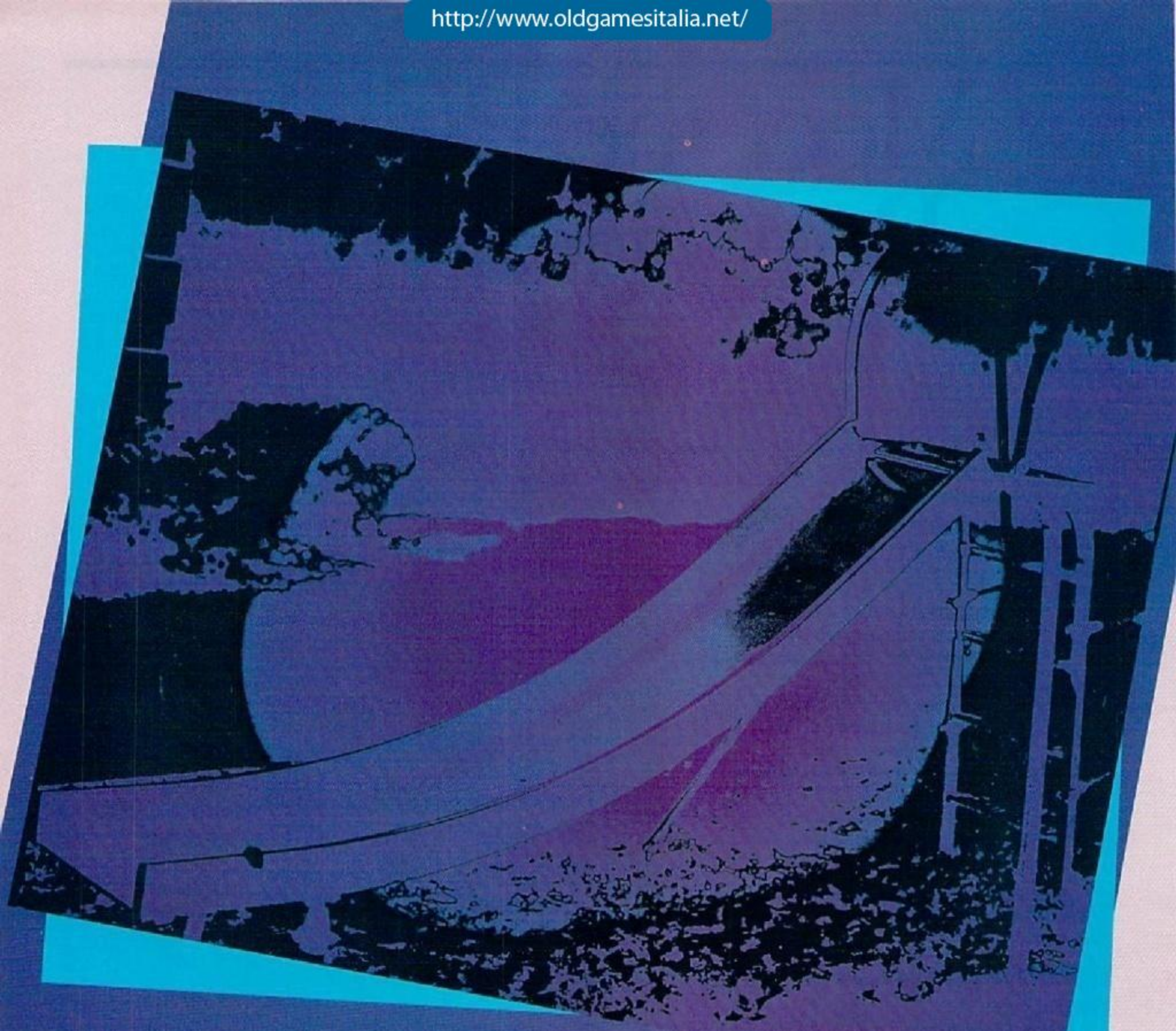

Five-in-a-row tic-tac-toe may sound easy, but don't be deceived. This game of strategy offers a slippery set of circumstances that can send you on either a smooth ride or a turbulent tumble.

By Robert Rossa

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SLIDE

Slide is a simple strategic board game that pits you against the computer, which has been programmed with a greedy strategy and rarely loses.

Slide is played on a five-by-five square board with 25 cells. You and the computer take turns entering single tokens from the top (numbered 1–5) or the left (lettered A–E). A token entered into a row or column will slide tokens already present on the board over or down one cell. Tokens may be shoved off the game board. The first player to have five tokens in a row, either horizontally, vertically or diagonally, wins.

On the game boards drawn by this program, the computer has the crosses and you have the circles. In the sample position shown in Fig. 1, you win (horizontally) by making move 2, but lose (diagonally) by making move C.

Making the Best Move

The first few moves of the computer are random, to provide some variety in the games. You can select how many moves in advance the computer can consider—either two, four, six or eight moves ahead. Obviously, the more moves ahead, the more time it will take the computer to make a selection. You can gradually advance the level of play as you learn the game.

To determine its best move, the computer must look at the game tree (see Fig. 2). Each move is drawn as a branch of a tree. Note that the tree is drawn with its branches hanging downward. Each path downward from the root (at the top) represents a possible sequence of moves. Each move has a value, so you can pick the move with the largest value.

For speed, the move-selection logic is written in machine language. I wrote the algorithm in Basic and then translated it into machine language. In Basic, at level 4, I could mow the lawn while the computer was deciding its next move. Another factor allowing more speed is the use of pruning; we don't have to consider all possible moves four plays ahead.

Each position is given a numerical weight, which is intended to measure a player's advantage. If the player who just moved has a win, the weight is as large as possible, in this case, 32.

If the opposing player wins, the weight is −32, as small as possible. Otherwise, the weight is the advantage the player who just moved has over his opponent.

There are ten possible moves from any position. How can a player determine the best move? Suppose you are looking just two levels ahead. For each of your ten possible moves, you look at what your opponent can do. For each of your possible moves, your opponent has ten possibilities, so there are 100 combinations of moves.

For each move you can make, you want to know how well your opponent can do. So you assume that your opponent will select a move by picking the position of maximum weight. The value of your move is then the negative of this maximum weight.

Pruning the Game Tree

If you search four levels ahead, it seems that you might have to look at all 10,000 sequences: you move, then your opponent moves, then you move again, then your opponent moves. For each of the 1000 possibilities at level 3, the value is the negative of your opponent's best possible move.

For each of the 100 positions at level 2, the value (to your opponent) is the negative of *your* best possible move. Finally, at level 1, the value of each of your ten possible moves is the negative

Address all author correspondence to Robert Rossa, 1901 Starling, Jonesboro, AR 72401.

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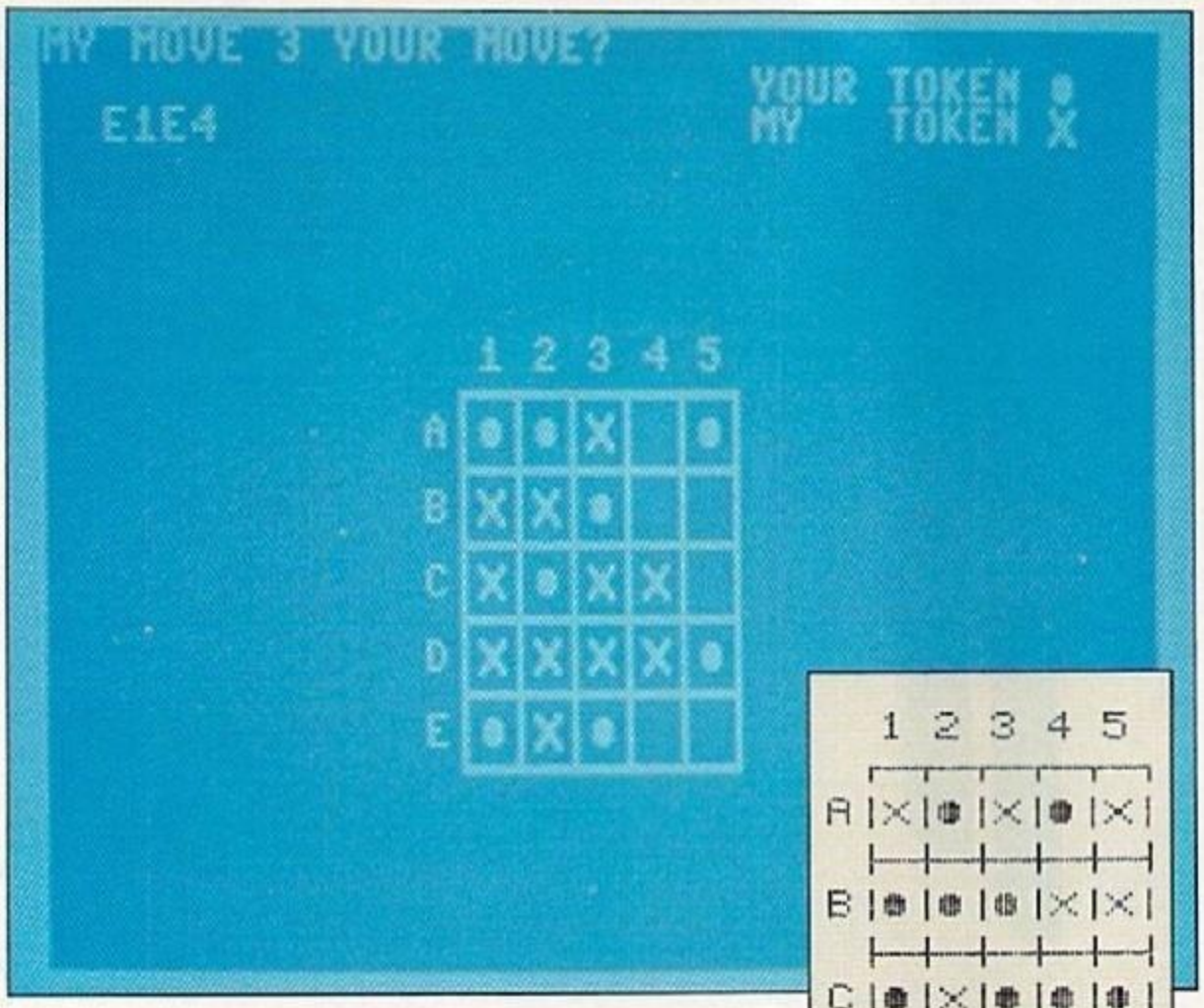

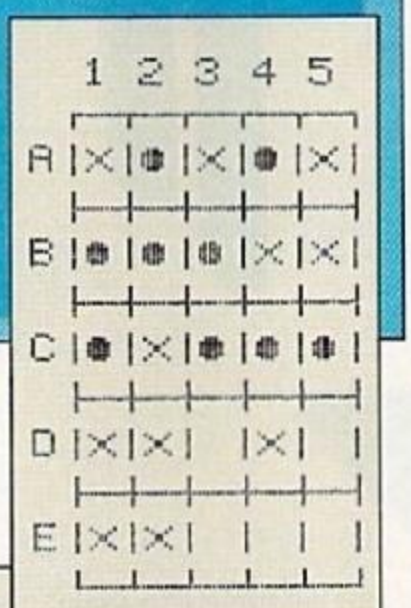

Fig. 1. Sample program output.

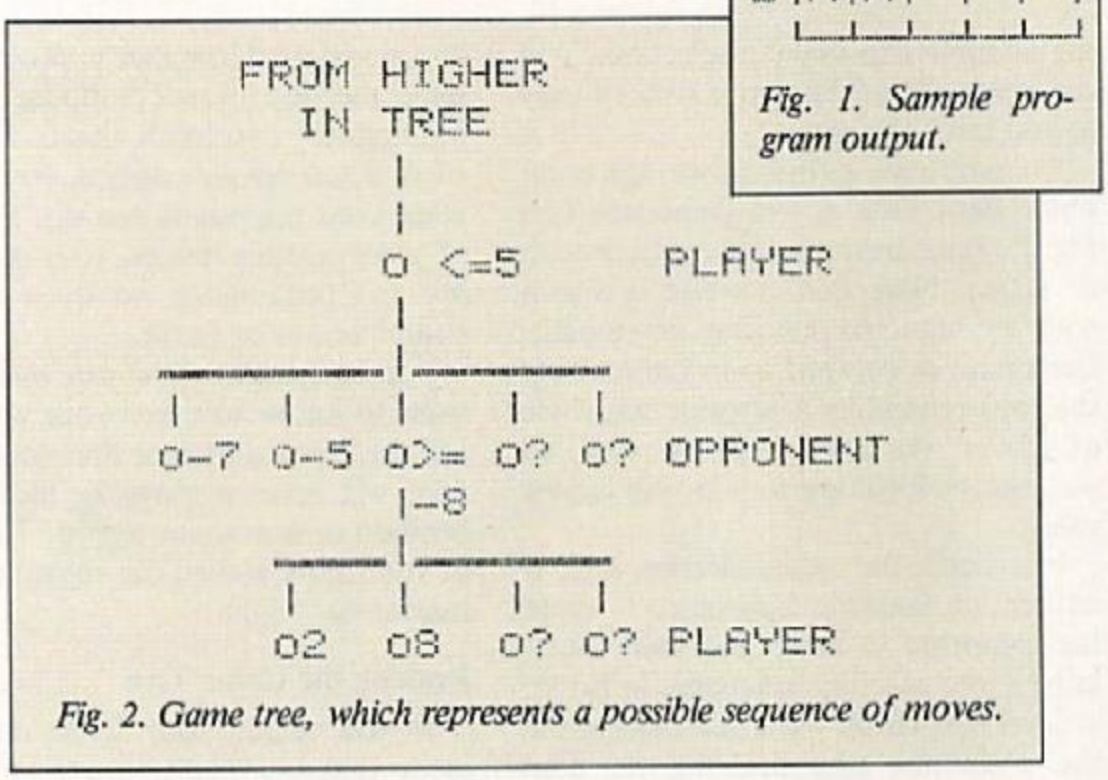

Fig. 2. Game tree, which represents a possible sequence of moves.

of your opponent's best possible moves.

If you search six levels ahead, you'll have 1,000,000 sequences at which to look. Clearly, this is a tedious task even for a computer. Fortunately, there's a way of eliminating most of the possible sequences—it's called pruning the game tree.

For example, consider Fig. 2. Suppose it represents your knowledge about a particular part of a game tree just as you finish finding the value of the second game position in the bottom row. When you find that this value is 8, then you can say that the value of the position just above it (its parent) can't be better than −8 for your opponent.

Since your opponent already knows he has better moves, including one with a value of −5, there is no need to continue evaluating the other possibilities (children) of the position. At this point, you can prune the game tree, that is, stop considering the −8 position and move on to the position to its right in the figure.

You'll be able to follow this pruning process when you play the game, since the program places the moves it's considering on the screen.

The Program

To load and play the game, you need only enter the Basic listings. The first Basic program (Listing 1), consisting mostly of Data statements, Pokes the machine language needed by the game. The second program (Listing 2) plays the game.

Listing 2 begins by protecting the machine code. Then it gets the game tree's depth of search by asking you to choose a level.

The variable CC, initialized in line 90, counts the moves made by the computer while it is playing randomly. The control for random moving is in line 280. The variable BQ is the move number, which is needed by the subroutine that updates the screen and internal game boards.

Lines 100–120 decide which player starts. AQ is a code for the current player; 1 is you and −1 is the computer. Line 130 is executed if the computer moves first; it sets up the game board and makes the computer's first move. Line 140 sets up the game board if you move first.

Lines 150–240 obtain a player's move, recode it for the routine that updates the board and then call that routine.

The game board is coded in memory in the 25 bytes starting at location 28672 (A in line 470). When the search routine is called, it calls itself recursively. It needs up to eight copies of the game board, depending on the level you choose. These are located in the 200 bytes beginning at location A.

The board evaluation routine, called from the Basic program by SYS RT in lines 260 and 320, needs to know which

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You must match wits against the C-64 in placing five tokens in a row—either vertically, horizontally or diagonally—on the game board.

of these eight boards it is supposed to evaluate. This is the purpose of location LZ, which is Poked in lines 260 and 320.

The evaluation routine returns a 1 in location CZ, if you have five in a row; otherwise, it returns a 0. Location CZ+1 is the return for the computer, so lines 260 and 270 check to see if there is a winner. S4 and T4 keep track of the number of wins for each player.

Line 290 calls the tree-search routine that selects the computer's move. BQ is the move picked; if the computer has only losing moves, you force move 1 in line 300. Line 310 then updates the board. Lines 320–340 check for a winner and then cycle back for the next move. Lines 350–360 contain the logic for a random move by the computer.

The subroutine at 370–520 sets a number of constants: S, the starting location of the screen; DN, the screen width; MR and MC, the starting row and column for the game board on the screen; LC, the starting screen RAM location for the board; D2, twice the screen width; and the characters used to draw the board.

Certain vital memory locations are given symbolic names in line 470. In line 510, the internal board at level 0 in array A is initialized. Line 510 is also executed before each new game.

The subroutine in lines 530–710 builds the screen, using the symbolic parameters set up by the initialization routine. The routine in lines 720–1070 updates the board after a move. The level 0 board in array A is looked at by this routine. Peeks and Pokes must be used, since A is not a Basic dimensioned array.

Finally, the last few lines at 1080–1130 print the score and provide for a continuation of the match. I have found the match at level 6 to be pretty uneven—in the computer's favor. R

Note: If you want the assembly language version, to understand how the evaluation algorithm works, send your request with a self-addressed stamped envelope to RUN *editorial office, 80 Pine St., Peterborough, NH 03458.*

RUN It Right

Commodore 64

Listing 1. Loads machine code for the Slide game.

```
5 REM LOADS MACHINE CODE FOR SLIDE GAME.
1Ø DATA 162 , 2Ø , 169 , Ø , 157 , 2ØØ , 112 , 2Ø2
2Ø DATA 16 , 25Ø , 174 , 225 , 112 , 24 , 1Ø5 , 25
3Ø DATA 2Ø2 , 16 , 251 , 168 , 136 , 169 , 4 , 141
4Ø DATA 22Ø , 112 , 169 , Ø , 141 , 218 , 112 , 141
5Ø DATA 219 , 112 , 169 , 4 , 141 , 221 , 112 , 185
6Ø DATA Ø , 111 , 24Ø , 56 , 16 , 2 , 169 , 2
7Ø DATA 17Ø , 2Ø2 , 254 , 218 , 112 , 169 , Ø , 24
8Ø DATA 125 , 223 , 112 , 1Ø9 , 221 , 112 , 142 , 222
9Ø DATA 112 , 17Ø , 254 , 2Ø4 , 112 , 174 , 222 , 112
1ØØ DATA 173 , 22Ø , 112 , 2Ø5 , 221 , 112 , 2Ø8 , 3
11Ø DATA 254 , 214 , 112 , 169 , 4 , 56 , 237 , 221
12Ø DATA 112 , 2Ø5 , 22Ø , 112 , 2Ø8 , 3 , 254 , 216
13Ø DATA 112 , 254 , 2Ø2 , 112 , 136 , 2Ø6 , 221 , 112
14Ø DATA 16 , 189 , 169 , 5 , 2Ø5 , 218 , 112 , 2Ø8
15Ø DATA 8 , 169 , 1 , 141 , 2ØØ , 112 , 76 , 131
16Ø DATA 96 , 2Ø5 , 219 , 112 , 2Ø8 , 5 , 169 , 1
17Ø DATA 141 , 2Ø1 , 112 , 2Ø6 , 22Ø , 112 , 16 , 146
18Ø DATA 162 , 9 , 16Ø , 4 , 189 , 2Ø4 , 112 , 2Ø1
19Ø DATA 5 , 2Ø8 , 5 , 169 , 1 , 141 , 2Ø1 , 112
2ØØ DATA 2Ø2 , 136 , 16 , 24Ø , 189 , 2Ø4 , 112 , 2Ø1
21Ø DATA 5 , 2Ø8 , 5 , 169 , 1 , 141 , 2ØØ , 112
22Ø DATA 2Ø2 , 16 , 241 , 169 , 5 , 16Ø , 1 , 2Ø5
23Ø DATA 214 , 112 , 2Ø8 , 3 , 14Ø , 2ØØ , 112 , 2Ø5
24Ø DATA 215 , 112 , 2Ø8 , 3 , 14Ø , 2Ø1 , 112 , 2Ø5
25Ø DATA 216 , 112 , 2Ø8 , 3 , 14Ø , 2ØØ , 112 , 2Ø5
26Ø DATA 217 , 112 , 2Ø8 , 3 , 14Ø , 2Ø1 , 112 , 96
27Ø DATA 169 , Ø , 141 , 25Ø , 112 , 174 , 254 , 112
28Ø DATA 189 , 226 , 112 , 188 , 236 , 112 , 141 , 235
29Ø DATA 112 , 136 , 152 , 2Ø1 , 5 , 16 , 54 , 24
3ØØ DATA 1Ø9 , 235 , 112 , 16Ø , 3 , 17Ø , 238 , 25Ø
31Ø DATA 112 , 189 , Ø , 111 , 24Ø , 11 , 232 , 232
32Ø DATA 232 , 232 , 232 , 136 , 16 , 24Ø , 238 , 25Ø
33Ø DATA 112 , 2Ø6 , 25Ø , 112 , 24Ø , 2Ø , 138 , 168
34Ø DATA 136 , 136 , 136 , 136 , 136 , 185 , Ø , 111
35Ø DATA 157 , Ø , 111 , 152 , 17Ø , 2Ø6 , 25Ø , 112
36Ø DATA 2Ø8 , 238 , 76 , 83 , 97 , 2ØØ , 233 , 5
37Ø DATA 168 , 173 , 235 , 112 , 136 , 48 , 5 , 24
38Ø DATA 1Ø5 , 5 , 16 , 248 , 16Ø , Ø , 14Ø , 25Ø
39Ø DATA 112 , 16Ø , 3 , 17Ø , 189 , Ø , 111 , 24Ø
4ØØ DATA 7 , 238 , 25Ø , 112 , 232 , 136 , 16 , 244
```

More

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Listing 1 continued.

```
41Ø DATA 2Ø6 , 25Ø , 112 , 48 , 14 , 138 , 168 , 136
42Ø DATA 185 , Ø , 111 , 157 , Ø , 111 , 2Ø2 , 136
43Ø DATA 76 , 64 , 97 , 173 , 255 , 112 , 157 , Ø
44Ø DATA 111 , 96 , 17Ø , 17Ø , 17Ø , 17Ø , 17Ø , 17Ø
45Ø DATA 17Ø , 17Ø , 17Ø , 17Ø , 17Ø , 17Ø , 17Ø , 17Ø
46Ø DATA 17Ø , 17Ø , 17Ø , 17Ø , 17Ø , 17Ø , 17Ø , 17Ø
47Ø DATA 174 , 254 , 112 , 188 , 226 , 112 , 2Ø2 , 189
48Ø DATA 226 , 112 , 17Ø , 169 , 24 , 141 , Ø , 113
49Ø DATA 189 , Ø , 111 , 153 , Ø , 111 , 232 , 2ØØ
5ØØ DATA 2Ø6 , Ø , 113 , 16 , 243 , 96 , 17Ø , 17Ø
51Ø DATA 172 , 254 , 112 , 19Ø , 236 , 112 , 189 , 1
52Ø DATA 113 , 153 , 81 , ØØ4, 96 , 17Ø , 17Ø , 17Ø
53Ø DATA 17Ø , 17Ø , 17Ø , 17Ø , 17Ø , 17Ø , 17Ø , 17Ø
54Ø DATA 17Ø , 17Ø , 17Ø , 17Ø , 17Ø , 17Ø , 17Ø , 17Ø
55Ø DATA 169 , 1 , 141 , 29 , 113 , 141 , 254 , 112
56Ø DATA 169 , 255 , 141 , 255 , 112 , 76 , 212 , 97
57Ø DATA 169 , 1 , 56 , 237 , 29 , 113 , 141 , 29
58Ø DATA 113 , 173 , 255 , 112 , 73 , 254 , 141 , 255
59Ø DATA 112 , 238 , 254 , 112 , 174 , 254 , 112 , 169
6ØØ DATA Ø , 157 , 11 , 113 , 169 , 224 , 157 , 2Ø
61Ø DATA 113 , 169 , 1 , 157 , 236 , 112 , 32 , 112
62Ø DATA 97 , 32 , 144 , 97 , 32 , 2Ø8 , 96 , 173
63Ø DATA 254 , 112 , 141 , 225 , 112 , 32 , Ø , 96
64Ø DATA 174 , 29 , 113 , 189 , 2ØØ , 112 , 24Ø , 17
65Ø DATA 174 , 254 , 112 , 189 , 236 , 112 , 157 , 11
66Ø DATA 113 , 169 , 32 , 157 , 2Ø , 113 , 76 , 228
67Ø DATA 98 , 169 , 1 , 56 , 237 , 29 , 113 , 17Ø
68Ø DATA 189 , 2ØØ , 112 , 24Ø , 3 , 76 , 212 , 98
69Ø DATA 173 , 254 , 112 , 2Ø1 , 1 , 24Ø , 71 , 2Ø5
7ØØ DATA 3Ø , 113 , 24Ø , 97 , 32 , 192 , 97 , 169
71Ø DATA Ø , 174 , 254 , 112 , 232 , 56 , 253 , 2Ø
72Ø DATA 113 , 2Ø1 , 224 , 24Ø , 224 , 174 , 254 , 112
73Ø DATA 221 , 2Ø , 113 , 48 , 11 , 48 , 9 , 157
74Ø DATA 2Ø , 113 , 189 , 236 , 112 , 157 , 11 , 113
75Ø DATA 174 , 254 , 112 , 2Ø2 , 189 , 236 , 112 , 2Ø1
76Ø DATA 1 , 48 , 13 , 174 , 254 , 112 , 189 , 2Ø
77Ø DATA 113 , 2Ø2 , 24 , 125 , 2Ø , 113 , 16 , 3
78Ø DATA 76 , 212 , 98 , 76 , 228 , 98 , 32 , 192
79Ø DATA 97 , 162 , 2 , 169 , Ø , 56 , 253 , 2Ø
8ØØ DATA 113 , 2Ø2 , 221 , 2Ø , 113 , 48 , 11 , 24Ø
81Ø DATA 9 , 157 , 2Ø , 113 , 189 , 236 , 112 , 157
82Ø DATA 11 , 113 , 76 , 212 , 98 , 174 , 29 , 113
83Ø DATA 189 , 2Ø2 , 112 , 168 , 169 , 1 , 56 , 237
84Ø DATA 29 , 113 , 17Ø , 152 , 56 , 253 , 2Ø2 , 112
85Ø DATA 174 , 254 , 112 , 221 , 2Ø , 113 , 48 , 11
86Ø DATA 24Ø , 9 , 157 , 2Ø , 113 , 189 , 236 , 112
87Ø DATA 157 , 11 , 113 , 173 , 3Ø , 113 , 2Ø1 , 2
88Ø DATA 24Ø , 26 , 174 , 254 , 112 , 2Ø2 , 189 , 236
89Ø DATA 112 , 2Ø1 , 1 , 24Ø , 15 , 174 , 254 , 112
9ØØ DATA 169 , Ø , 56 , 253 , 2Ø , 113 , 2Ø2 , 221
91Ø DATA 2Ø , 113 , 16 , 16 , 174 , 254 , 112 , 254
92Ø DATA 236 , 112 , 189 , 236 , 112 , 2Ø1 , 11 , 24Ø
93Ø DATA 3 , 76 , 23Ø , 97 , 169 , 1 , 56 , 237
94Ø DATA 29 , 113 , 141 , 29 , 113 , 173 , 255 , 112
95Ø DATA 73 , 254 , 141 , 255 , 112 , 2Ø6 , 254 , 112
96Ø DATA 96 , 17Ø , 17Ø , 17Ø , 17Ø , 17Ø , 17Ø , 17Ø
969 REM TO CHANGE GAME COLOR CHANGE 14 IN LINE 97Ø TO D
    ESIRED COLOR.
97Ø DATA 169 ,14 , 162 , 251 , 157 , 255 , 215 , 157
98Ø DATA 249 , 216 , 157 , 243 , 217 , 157 , 237 , 218
99Ø DATA 2Ø2 , 2Ø8 , 241 , 96 , 17Ø , 17Ø , 17Ø , 17Ø
1ØØØ DATAØ,25,5Ø,75,1ØØ,125,15Ø,175,2ØØ
1Ø1Ø DATA49,5Ø,51,52,53,1,2,3,4,5
8ØØØ FORI=24576TO25367
8Ø1Ø READK
8Ø2Ø POKEI,K
8Ø3Ø NEXTI
81ØØ FORI=28898TO289Ø6
811Ø READK
812Ø POKEI,K
813Ø NEXTI
814Ø FORI=2893ØTO28939
815Ø READK
816Ø POKEI,K
817Ø NEXTI
818Ø POKE28895,Ø:POKE28896,5
82ØØ PRINT"{SHFT CLR}NOW LOAD AND RUN THE SECOND PROGRA
    M":STOP
```

Listing 2. Slide program for the C-64.

```
1Ø POKE51,Ø:POKE52,96:POKE55,Ø:POKE56,96:GOSUB12ØØ
2Ø INPUT"WHAT LEVEL-2,4,6,OR 8";WG:WG=INT(WG)
3Ø IF WG<2THENWG=2
4Ø IFWG>8THENWG=8
5Ø IFWG=3ORWG=5ORWG=7THENWG=WG+1
6Ø PRINT"LEVEL=";WG
7Ø RU= 24784:AU=28927:LU=28926:IU=289Ø8:RT=24576
8Ø GOSUB37Ø
9Ø CC=1:BQ=Ø
1ØØ PRINT"YOU FIRST?"
11Ø GETA$:IFA$=""THEN11Ø
12Ø IFA$="Y"THENAQ=1:GOTO14Ø
13Ø AQ=-1:BQ=1:GOSUB53Ø:GOSUB72Ø:GOTO15Ø
14Ø GOSUB53Ø
15Ø PRINT"{HOME}{35 SPACEs}{HOME}";
16Ø IFBQ>ØTHENPRINT"{HOME}MY MOVE "V$(BQ);
17Ø PRINT" YOUR MOVE?{2 SPACEs}{CRSR LF}"
18Ø GETA$
19Ø IFA$=""THEN18Ø
2ØØ PRINT"{HOME}{1Ø SPACEs}YOUR MOVE ";A$
21Ø IF(A$>"Ø"ANDA$<"6")THENBQ=ASC(A$)-48:GOTO24Ø
22Ø IF(A$>="A"ANDA$<="E")THENBQ=ASC(A$)-59:GOTO24Ø
```

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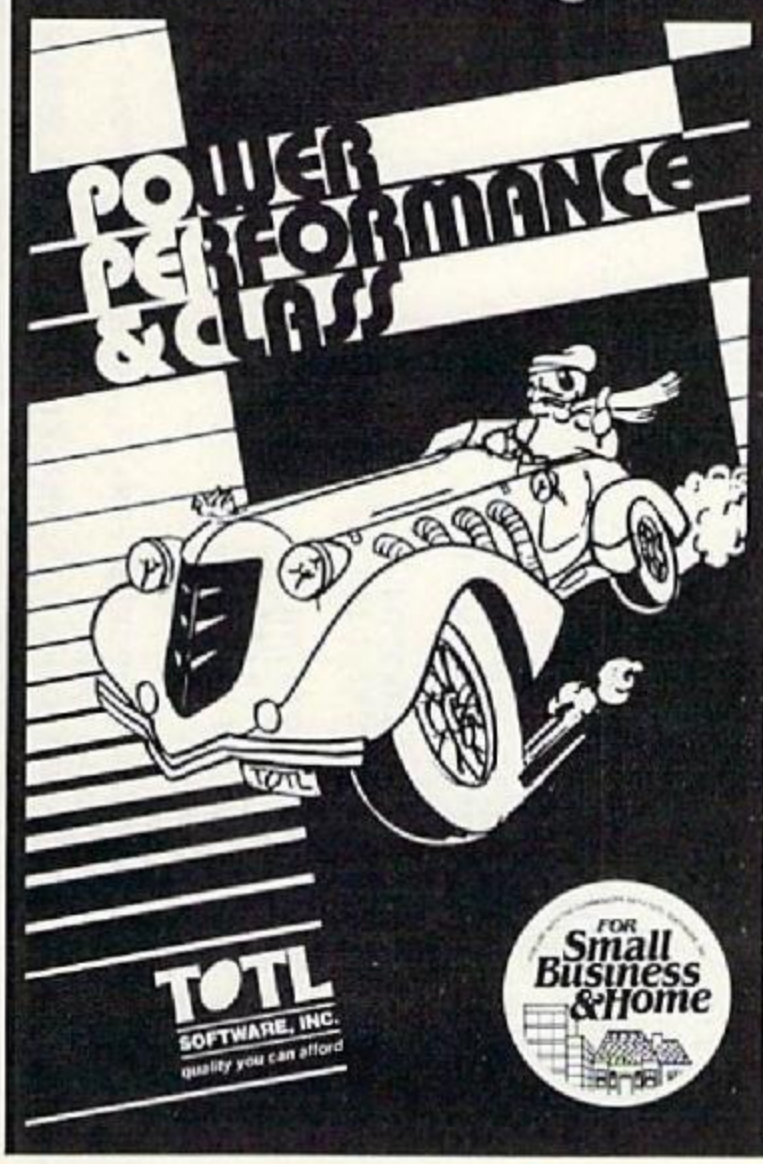

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Listing 2 continued.

```
23Ø GOTO15Ø
24Ø AQ=1:GOSUB72Ø
26Ø POKELZ,Ø:SYSRT:IFPEEK(CZ)=1THENPRINT"YOU WIN!{6 SPA
    CEs}":T4=T4+1:GOTO1Ø8Ø
27Ø IFPEEK(CZ+1)=1THENPRINT"I WIN!{14 SPACEs}":S4=S4+1:
    GOTO1Ø8Ø
28Ø IFCC<4THEN35Ø
29Ø SYS25Ø08
3ØØ BQ=PEEK(2894Ø):IFBQ=ØTHENBQ=1
31Ø AQ=-1:GOSUB72Ø
32Ø POKELZ,Ø:SYSRT:IFPEEK(CZ+1)=1THENPRINT"I WIN!{5 SPA
    CEs}":S4=S4+1:GOTO1Ø8Ø
33Ø IFPEEK(CZ)=1THENPRINT"YOU WIN!{9 SPACEs}":T4=T4+1:G
    OTO1Ø8Ø
34Ø GOTO15Ø
35Ø CC=CC+1:BQ=INT(RND(XX)*1Ø+1)
36Ø GOTO31Ø
37Ø REM INITIALIZE
38Ø S=1Ø24:DN=4Ø:REM FOR 4Ø-COLUMN SCREEN USE DN=4Ø
4ØØ MR=8:MC=13
41Ø POKE28958,WG
42Ø LC=S+DN*MR+MC:D2=2*DN
43Ø VB=93:HB=64:XX=91:TH=114:BH=113:LH=1Ø7:RH=115
44Ø PRINTCHR$(142)
45Ø UL=112:UR=11Ø:BL=1Ø9:BR=125
46Ø WH=81:BK=86
47Ø A=28416:CZ=28872:PZ=28874:LZ=28897
49Ø DATA1,2,3,4,5,A,B,C,D,E
5ØØ FORI=1TO1Ø:READV$(I):NEXT
51Ø FORI=ØTO24:POKEA+I,Ø:NEXTI
52Ø RETURN
53Ø REM BUILD SCREEN
54Ø PRINT"{SHFT CLR}":SYS25344
55Ø FORI=1TO5
56Ø POKELC+2*I,48+I
57Ø POKELC+D2*I,I
58Ø FORJ=ØTO5
59Ø POKELC+D2*I+1+2*J,VB
6ØØ POKELC+2*I+D2*J+DN,HB
61Ø NEXTJ:NEXTI
62Ø FORI=1TO4:FORJ=1TO4
63Ø POKELC+DN+1+2*I+D2*J,XX
64Ø NEXTJ
65Ø POKELC+DN+1+2*I,TH
66Ø POKELC+11*DN+1+2*I,BH
67Ø POKELC+DN+1+D2*I,LH
68Ø POKELC+DN+11+D2*I,RH
69Ø NEXTI
7ØØ POKELC+1+DN,UL:POKELC+DN+11,UR:POKELC+11*DN+1,BL:PO
    KELC+11*DN+11,BR
7Ø5 PRINT"{HOME}{COMD 7}":PRINTTAB(25);"YOUR TOKEN {SHF
    T Q}":PRINTTAB(25);"MY{3 SPACEs}TOKEN {SHFT V}"
71Ø RETURN
72Ø REM INSERT TOKEN INTO CURRENT COPY OF GAME AND ALSO
     SCREEN.
73Ø REM ON ENTRY AQ=1 IF PLAYER IS WHITE, -1 IF BLACK.
74Ø REM BQ IN RANGE 1-5 FOR COLUMN, 6-1Ø FOR ROW.
75Ø TQ=WH:NQ=1:IFAQ=-1THENTQ=BK:NQ=255
76Ø CQ=BQ-1:IFBQ>5THEN87Ø
77Ø GOSUB98Ø:IFQQ=ØTHEN84Ø
78Ø FORI=QQTO1STEP-1
79Ø IQ=I-1
8ØØ EQ=PEEK(A+5*IQ+CQ):POKEA+5*I+CQ,EQ
81Ø VQ=PEEK(LC+D2*I+BQ*2)
82Ø POKELC+D2+D2*I+BQ*2,VQ
83Ø NEXTI
84Ø POKEA+CQ,NQ
85Ø POKELC+D2+BQ*2,TQ
86Ø GOTO97Ø
87Ø CQ=BQ-6:RQ=5*CQ:GOSUB1Ø3Ø
88Ø IFQQ=ØTHEN95Ø
89Ø FORI=QQTO1STEP-1
9ØØ IQ=I-1
91Ø EQ=PEEK(A+RQ+IQ):POKEA+RQ+I,EQ
92Ø VQ=PEEK(LC+D2+D2*CQ+I*2)
93Ø POKELC+D2+D2*CQ+I*2+2,VQ
94Ø NEXTI
95Ø POKEA+RQ,NQ
96Ø POKELC+D2+D2*CQ+2,TQ
97Ø RETURN
98Ø QQ=4
99Ø FORI=ØTO3
1ØØØ IFPEEK(A+5*I+CQ)=ØTHENQQ=I:I=4
1Ø1Ø NEXTI
1Ø2Ø RETURN
1Ø3Ø QQ=4
1Ø4Ø FORI=ØTO3
1Ø5Ø IFPEEK(A+RQ+I)=ØTHENQQ=I:I=4
1Ø6Ø NEXTI
1Ø7Ø RETURN
1Ø8Ø PRINT"GAMES: YOU ";T4;"{3 SPACEs}ME ";S4
1Ø9Ø PRINT"WANT ANOTHER GAME?"
11ØØ GETA$
111Ø IFA$=""THEN11ØØ
112Ø IFA$><"N"THENGOSUB51Ø:GOTO9Ø
113Ø PRINT"THANK YOU":STOP
12ØØ PRINT"{SHFT CLR}{17 SPACEs}SLIDE"
121Ø PRINT"{12 SPACEs}BY ROBERT ROSSA"
122Ø PRINT"{7 SPACEs}ARKANSAS STATE UNIVERSITY"
123Ø PRINT:PRINT:PRINT"{4 SPACEs}GET FIVE TOKENS IN A R
    OW TO WIN"
124Ø FORI=1TO2ØØØ:NEXT
125Ø RETURN
```

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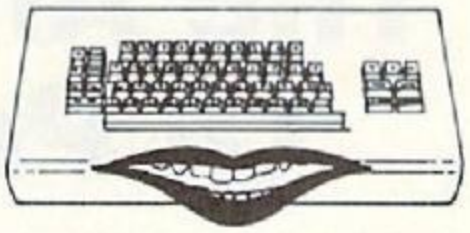

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The Art and Science Of Programming

Programming is both an art and a science. This article discusses various techniques to help you become a more creative and more competent programmer.

By John Kula

There are two prerequisites you should consider before any programming begins. Without them, a program can still be good, but it will never be great.

The first is research, which means acquiring a complete understanding not only of all the facts pertinent to the intended program, but also of the program's *intent*.

For example, if you want to write a utility program that renumbers the lines of programs in memory, you must also decide (among other things) whether you intend to renumber all the embedded line numbers (i.e., those that follow a GOTO, GOSUB and so on) or whether you intend to catch them manually after-the-fact.

There's nothing inherently wrong in either choice, as long as the choice was intentional. But if you didn't do your research, and thus weren't aware of any limitation, that's another story.

The line renumberer is a very simple, almost trivial, example; the principle becomes more significant as the complexity of the program increases. I'm currently working on a simulation for the C-64 that will require a total of over 100K of memory (more on that in a while). Naturally, it's complex, and my research took three months to amass; but I'm confident that I've covered at least 95% of the angles.

The second prerequisite is a precis. Some programmers insist that nothing short of a complete and detailed flowchart will suffice, but I suspect this is a hangover from the days when programs had to be written in machine language. Although certain portions of a program may need flowcharting, this is necessary only when the logical sequence of events begins to get a bit convoluted.

Of more importance in the overall scheme of events is a summary of the program's major steps and blocks. When a flowchart can't be avoided, however, don't worry about the correct usage of the symbols right away... you'll learn that with experience. Those symbols were developed as aids and shouldn't end up being stumbling blocks.

Writing a Program

There's no strict sequence of events in the actual writing of a program. You must write code before there's anything to debug. Obviously, with enough work, any piece of coding could be made more simple and elegant. But you should avoid the word-processor syndrome.

Word processors can make changes very easily, thus giving the impression that perfection is only one more draft away. So it is with computers, particularly those with good screen editors.

Once your program does what it was intended to do with no apparent bugs, take a stab or two at condensing it and then leave it be! The more you tinker with it, the more likely you are to introduce some extraneous bug. Knowing when to stop is a greater advantage than saving one or two more bytes of memory.

I find it most useful to keep two versions of a completed program on file. The working copy is the condensed version, so it takes less time to load and run. The backup copy is fully expanded and documented, so if I must make changes months later, (and it's a rare program that won't benefit from changes), I can follow the logic and remember my assumptions.

Documenting a Program

I've found a couple of techniques to be particularly useful in documenting a program. First, I frequently use the REM statement to explain what's happening in key areas and to identify each subroutine. I often use line numbers

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that end in zero for program lines and those that end in any other digit for remarks or spacings (a line that contains only a colon has no effect on the program, but leaves a very satisfying separation on a listing). This numbering system helps me delete unwanted lines when I'm condensing the program into a working version.

The only caution here is that the target line for a GOTO or GOSUB statement should not be a line you're using for a remark or space. Even if you never intend to condense the program, you might eventually give it to someone (like myself) who will. Be kind to us inveterate tamperers.

A second valuable technique is to indent all For...Next loops, as is common in Pascal. This makes the logic of the listing easier to follow and helps flag any errors in loop nesting. Again, leading colons work well for indentation; you can stack them as high as you want without any ill effect.

As a final note, the first two lines of every one of my backup programs contain printer information for listings. All my listings begin with the filename in expanded print and the date of the last update or amendment. I keep the milestone listings (those with important and/or significant changes) in dead storage for future reference. The others make satisfactory kindling for the fireplace.

Taking Command

It's a lot easier to write a program when you have access to some extended Basic commands. My most useful and most used program is Power 64, a programmer's utility, which gives me several very valuable additional commands.

A renumber command renumbers literal and embedded lines, usually has quite a few more bells and whistles, such as the ability to renumber line ranges within the program rather than the entire program (great for merging), and it's fast.

Search and substitute commands are my favorites; they do exactly what they suggest...search for a specified pattern (variable, keyword string and so on) and substitute. Deleting a range of line numbers with one command is handy. So is automatic line numbering. Single-stepping through a program aids debugging, as does dumping all variables.

This is only a partial list, but it gives an idea of what's available to make the job of coding and debugging less of an irritation.

Getting the Bugs Out

Debugging a program can be a frustrating experience and not even professionals get off lightly. Debugging actually involves two different kinds of bugs. The syntactical ones arise from errors in the use of Basic and are generally easy to spot, because most of them are fatal: an error message appears on the screen and the program stops running; or the computer locks up and doesn't respond to the keyboard; or the screen doesn't change for so long that you start to get suspicious (this latter bug is an endless loop, which isn't fatal in the strictest sense, but is just as effective at killing the program).

The other kind is the functional bug, which is more insidious because you don't find out about it until you run the program and receive unexpected answers or results. Because the syntactical bug indicates the line number in which your error might be, fatal errors should be the easiest to diagnose and correct.

What about the others? Well, there are essentially two possibilities: either the program's basic assumptions are incorrect and it's not a realistic simulation of actual events, or there's an error in the logic of the coding. Let's assume that you're absolutely confident of your program's accuracy; the alternative is unappealing and has few remedies other than some more research and recoding.

The solution involves narrowing down the search area. First, create some test data (the simpler and more trivial, the better) and write it into your program. Then go through and insert breakpoints (i.e., the Stop command) at every spot where data has just been manipulated.

Now run the program and check the data produced at each breakpoint against your own hand-calculated data. If they correspond, enter CONT and repeat the process at the next break. When you reach a break where the data isn't the same, you'll know the problem is somewhere between the last Stop command and this one. Of course, this debugging is a bit less tedious if you have a utility program with a trace function or single-step capability.

It's a Trap

One aspect of programming that isn't given much press coverage but is closely

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related to debugging is error-trapping, which detects any errors that could otherwise enter the system through user input. PET Basic, version 2.0, as contained in the VIC-20 and the C-64, does a bit of this automatically, but not nearly enough. Basic will trap you if you try to input a string when it expects a number, but not vice versa (of course it can't read your mind to know whether you meant it to be a numeric string or not).

For example, one of the big headaches in PET Basic is the null string. If the string variable contained no previous data, you get the null string when you respond to a string input prompt only by hitting the return key. We humans know there's nothing there, but the computer is not amused, particularly if you want it to find the ASCII value of the null string. A commonly touted solution has been to add a CHR$(0) to every string input. For example:

```
10 INPUT "STRING"; Q$
20 Q$ = Q$ + CHR$(0)
```

The theory behind this is that it won't affect a normal string, but will ensure that an accidental null string contains something recognizable to the computer. Unfortunately, this *does* add something to the string—a reverse @. So if at some point you need to find the length or the numerical value of the string, you'll end up with a more insidious problem than you had at the start.

Obviously, any piece of coding could be made more simple and elegant. But you should avoid the word-processor syndrome.

My own recommendation is more mundane, but it ensures there will never be a null string or unexpected additions to a string. It is:

```
10 INPUT "STRING"; Q$
20 IF Q$ = "" GOTO 10
```

Error-trapping involves taking into account every possible form of input and assessing its validity. Just because you specify a range of acceptable responses in your program doesn't mean that someone won't try another response, accidentally or not. If you expect a numeric response with a small range, use an ON...GOTO command to test the input. You may admonish bad data with an appropriately stern message, default it to some unpopular value or do something else with it.

The important point to remember about the ON...GOTO and ON...GOSUB commands is that they test for positive integers. Values of zero default to the following line in the program, as do values greater than the options for which you provide. For example:

```
10 INPUT"NUMBER (4 TO 6)";Q
20 ON Q-3 GOTO 40,50,60
30 PRINT"TRY AGAIN, TWIT":GOTO10
40 PRINT"Q=4": END
50 PRINT"Q=5": END
60 PRINT"Q=6": END
```

The input variable Q in line 10 has become the variable Q – 3 in line 20. If this variable is zero or greater than the number of items in the list, then the computer just ignores the ON...GOTO command (line 20) and executes the next line (line 30).

But what about negative variables? Those will result in a fatal ?Illegal Quantity error and a crash. And this is an excellent example of the need for error-trapping. Most people wouldn't bother trying to input a negative number, and it would be a highly unlikely accident. But in this example, an input of 0, 1 or 2 would result in a negative variable in line 20! Add the following error trap in line 15.

```
15 IF Q < 3 THEN Q = 3
```

All the angles have finally been covered.

Keeping your input routines as flexible as possible may not necessarily trap errors, but *will* make for better "liveware compatibility." The following routine is too rigid, allowing only two responses.

```
10 INPUT"READY TO CONTINUE";Q$
20 IF Q$="Y" GOTO 50
30 IF Q$="N" GOTO 10
40 PRINT"YOU ARE NAUGHTY etc. etc.
50 Continue with program
```

Why not allow a greater variety (yeh, yup, ya, nah, nope) by adding the following line.

```
15 Q$=LEFT$(Q$,1)
```

Better yet, since all you're trying to do is delay further execution until you're ready, all you really need is:

```
10 INPUT"READY TO CONTINUE";Q$
20 IF LEFT$(Q$,1)="N" GOTO 10
```

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To make life even easier (and let's face it, few users would bother typing N to the above prompt—they'd just wait until they were ready to continue and then type Y), why not offer the anticipated response in the prompt itself, so that you only have to hit the return key. Here's the coding for a new line 10:

```
INPUT
"
READY TO CONTINUE
{space}
{space}
{CTRL 9}
Y
{CTRL 0}
{CRSR LF}
{CRSR LF}
{CRSR LF}
"
;
Q$
```

If you type in this line and run it, you should see a Y flashing under the cursor prompt, after the input. You only have to hit the return key to activate the Y response. In this case, an even more elegant solution would be the following, which is what I usually use in these circumstances.

```
10 PRINT"HIT ANY KEY TO CONTINUE"
20 WAIT 197,64: WAIT 197,64,64
30 POKE 198,0
```

In case you're wondering, line 30 clears the keyboard buffer, so when you hit the key to continue the program, the key itself doesn't appear on the screen and cause an error.

Squeeze It

Program condensation makes good sense from many perspectives, but may become an absolute necessity if you ever encounter an ?Out Of Memory error. Remarks are a great place to start, especially since everything on a line consisting of a REM statement is stored in memory exactly as you type it—no number conversion or keyword tokenizing.

Elimination of all unnecessary blanks is another spacesaver, but caution is required here. Sometimes you must leave an extra space to prevent the computer from thinking it recognizes a keyword. For example, ON T AND S GOTO 130 can be condensed to ONT ANDSGOTO 130. The blank is required so that TAN is not treated as a keyword.

There are lots of such little tricks for picking up a few bytes here and there. But when that's not enough, you'll probably want to consider breaking up your increasingly large program into two or more smaller programs and loading them separately when required. This will only work, however, when each segment runs independently of the others, so be careful.

Although you may insert a Load command for execution when the program reaches it, there will be difficulties. There's no way to delete the old contents without also deleting your Load instruction. And if the new program is longer than the original, you'll run into problems as soon as the new program tries to load into the area used previously for variables. The simple solution is to trick the computer into thinking that it's executing a Load command from the keyboard; the Load command in the Immediate mode also automatically executes a New command.

To perform this, you must first set up the appropriate commands on the screen, in their appropriate locations, via Print statements. Then ASCII code 13s (returns) are Poked into the keyboard buffer. These returns are timed to coincide with the cursor being on the same line of the screen as one of the lines previously printed there. Once the first command, Load, has been executed, the cursor automatically moves down to the second line, RUN. The second return from the buffer executes this line, and the second program has been successfully loaded and run. Assuming that the new program filename is "NEW.PROG", here's the listing:

```
10 PRINT"{4 CRSR DNs}"
20 REM {CRSR DN} = CURSOR DOWN
30 PRINT"LOAD"CHR$(34)"0:NEW.PROG"
   CHR$(34)",8{4 CRSR DNs}"
40 PRINT"RUN"
50 PRINT"{9 CRSR UPs}"
60 REM {CRSR UP} = CURSOR UP
70 POKE 631,13:POKE 632,13
80 REM THESE ARE TWO <returns>
   POKED INTO THE KEYBOARD BUFFER
90 POKE 198,2
99 REM THIS SPECIFIES THAT THE
   BUFFER CURRENTLY CONTAINS TWO
   CHARACTERS
```

One final, little-known fact about computers. The integrated circuit chips in a computer actually run on smoke. If you sit at your computer too long and start to see smoke escaping, you'll know those little chips are soon going to run out of smoke and stop working. R

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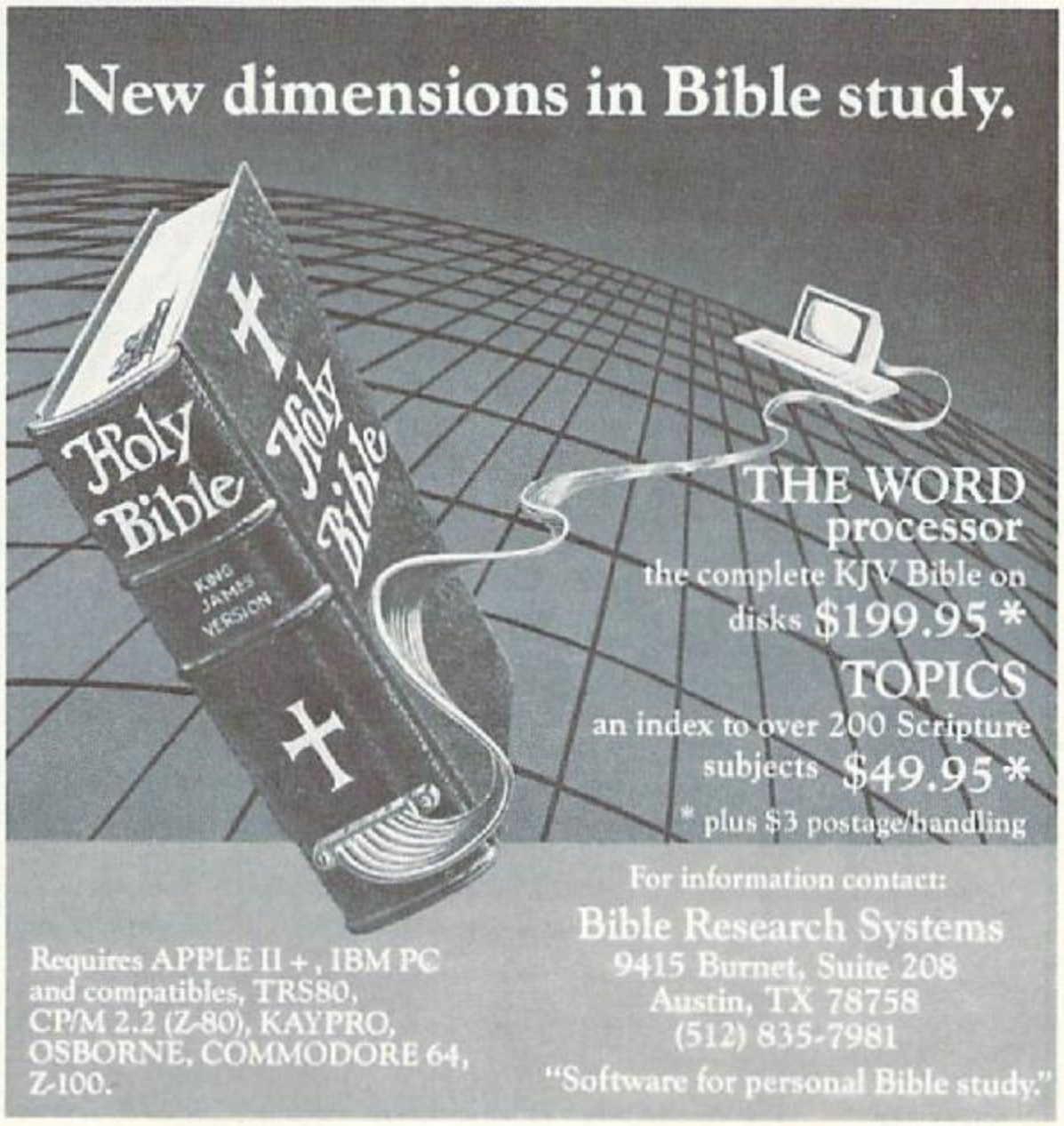
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Beale's Buried Treasure

(continued from p. 57)

```
670 PRINT
680 INPUT "CODE VALUE{9 SPACEs}";CV
690 INPUT "LETTER ASSIGNMENT{2 SPACEs}";L$
700 PRINT "{6 CRSR UPs}WORKING........."
710 FOR X = 1 TO WL
720 :{3 SPACEs}IF C(X) = CV THEN C$(X)=L$
730 NEXT X
740 GOTO 610
750 :
760 READ A:IF A<> -1 THEN PRINT"READ ERROR":END
770 RETURN
780 PRINT "WORKING......"
790 FOR X = 1 TO 518
800 :{3 SPACEs}READ A
810 NEXT X
820 RETURN
830 PRINT "WORKING......"
840 FOR X = 1 TO 763
850 :{3 SPACEs}READ A:C$(X)="-"
860 NEXT X
870 RETURN
880 PRINT "WORKING......"
890 FOR X = 1 TO 618
900 READ A
910 NEXT X
920 RETURN
930 PRINT "WORKING......"
940 FOR X = 1 TO 518
950 :{3 SPACEs}READ C(X)
960 NEXT X
970 RETURN
980 PRINT "WORKING......"
990 FOR X = 1 TO 763
1000 :{3 SPACEs}READ C(X):C$(X)="-"
1010 NEXT X
1020 RETURN
1030 PRINT "WORKING......"
1040 FOR X = 1 TO 618
1050 :{3 SPACEs}READ C(X)
1060 NEXT X
1070 RETURN
1080 :
1090 PRINT "WORKING......"
1100 FOR X = 1 TO 1322
1110 :{3 SPACEs}READ DC$(X)
1120 NEXT X
1130 FOR X = 1323 TO 2906
1140 :{3 SPACEs}DC$(X) = "-"
1150 NEXT X
1160 RETURN
1170 END
1180 REM{7 SPACEs}BEALE CODE --- PAPER ONE
1190 :
1200 DATA 71, 194, 38, 1701, 89, 76, 11, 83, 1629, 48,
     94, 63
1210 DATA 132, 16, 111, 95, 84, 341, 975, 14, 40, 64, 2
     7, 81
1220 DATA 139, 213, 63, 90, 1120, 8, 15, 3, 126, 2018,
     40, 74
1230 DATA 758, 485, 604, 230, 436, 664, 582, 150, 251,
     284
1240 DATA 308, 231, 124, 211, 486, 225, 401, 370, 11, 1
     01
1250 DATA 305, 139, 189, 17, 33, 88, 208, 193, 145, 1,
     94, 73
1260 DATA 416, 918, 263, 28, 500, 538, 356, 117, 136, 2
     19
1270 DATA 27, 176, 130, 10, 460, 25, 485, 18, 436, 65,
     84
1280 DATA 200, 283, 118, 320, 138, 36, 416, 280, 15, 71
     , 224
1290 DATA 961, 44, 16, 401, 39, 88, 61, 304, 12, 21, 24
     , 283
1300 DATA 134, 92, 63, 246, 486, 682, 7, 219, 184, 360,
      780
1310 DATA 18, 64, 463, 474, 131, 160, 79, 73, 440, 95,
     18, 64
1320 DATA 581, 34, 69, 128, 367, 460, 17, 81, 12, 103,
     820
1330 DATA 62, 116, 97, 103, 862, 70, 60, 1317, 471, 540
     , 208
1340 DATA 121, 890, 346, 36, 150, 59, 568, 614, 13, 120
     , 63
1350 DATA 219, 812, 2160, 1780, 99, 35, 18, 21, 136, 87
     2, 15
1360 DATA 28, 170, 88, 4, 30, 44, 112, 18, 147, 436, 19
     5, 320
1370 DATA 37, 122, 113, 6, 140, 8, 120, 305, 42, 58, 46
     1, 44
1380 DATA 106, 301, 13, 408, 680, 93, 86, 116, 530, 82,
      9
1390 DATA 102, 38, 416, 89, 71, 216, 728, 965, 818, 2,
     38
1400 DATA 121, 195, 14, 326, 148, 234, 18, 55, 131, 234
     , 361
1410 DATA 824, 5, 81, 623, 48, 961, 19, 26, 33, 10, 110
     1, 365
1420 DATA 92, 88, 181, 275, 346, 201, 206, 86, 36, 219,
      329
1430 DATA 829, 840, 68, 326, 19, 48, 122, 85, 216, 284,
      919
1440 DATA 861, 326, 985, 233, 64, 68, 232, 431, 960, 50
     , 29
1450 DATA 81, 216, 321, 603, 14, 612, 81, 360, 36, 51,
     62
1460 DATA 194, 78, 60, 200, 314, 676, 112, 4, 28, 18, 6
     1, 136
1470 DATA 247, 819, 821, 1060, 464, 895, 10, 6, 66, 119
     , 38
1480 DATA 41, 49, 602, 423, 962, 302, 294, 875, 78, 14,
      23
1490 DATA 111, 109, 62, 31, 501, 823, 216, 280, 34, 24,
      150
1500 DATA 1000, 162, 296, 19, 21, 17, 340, 19, 242, 86,
      234
1510 DATA 140, 607, 115, 33, 391, 67, 104, 86, 52, 88,
     16,80
1520 DATA 121, 67, 95, 122, 216, 548, 96, 11, 201, 77,
     364
1530 DATA 218, 65, 667, 890, 236, 154, 211, 10, 98, 34,
      119
1540 DATA 56, 216, 119, 71, 218, 1164, 1496, 1817, 51,
     39
1550 DATA 210, 36, 3, 19, 540, 232, 22, 141, 617, 84, 2
     90, 80
1560 DATA 46, 207, 411, 150, 29, 38, 46, 172, 85, 194,
     36
1570 DATA 261, 543, 897, 624, 18, 212, 416, 127, 931, 1
     9, 4
1580 DATA 63, 96, 12, 101, 418, 16, 140, 230, 460, 538,
      19
1590 DATA 27, 88, 612, 1431, 90, 716, 275, 74, 83, 11,
     426
1600 DATA 89, 72, 84, 1300, 1706, 814, 221, 132, 40, 10
     2, 34
1610 DATA 858, 975, 1101, 84, 16, 79, 23, 16, 81, 122,
     324
1620 DATA 403, 912, 227, 936, 447, 55, 86, 34, 43, 212,
      107
1630 DATA 96, 314, 264, 1065, 323, 428, 601, 203, 124,
     95
1640 DATA 216, 814, 2906, 654, 820, 2, 301, 112, 176, 2
     13
1650 DATA 71, 87, 96, 202, 35, 10, 2, 41, 17, 84, 221,
     736, 820
1660 DATA 214, 11, 60, 760, -1
1670 :
1680 :
1690 :
1700 REM{7 SPACEs}BEALE CODE --- PAPER TWO
1710 :
1720 :
1730 DATA 115, 73, 24, 818, 37, 52, 49, 17, 31, 62, 657
     , 22, 7, 15, 140, 47, 29
1740 DATA 107, 79, 84, 56, 238, 10, 26, 822, 5, 195, 30
     8, 85, 52, 159, 136, 59
1750 DATA 210, 36, 9, 46, 316, 543, 122, 106, 95, 53, 5
     8, 2, 42, 7, 35, 122
1760 DATA 53, 31, 82, 77, 250, 195, 56, 96, 118, 71, 14
     0, 287, 28, 353, 37
1770 DATA 994, 65, 147, 818, 24, 3, 8, 12, 47, 43, 59,
     818, 45, 316, 101, 41
1780 DATA 78, 154, 994, 122, 138, 190, 16, 77, 49, 102,
      57, 72, 34, 73, 85, 35
1790 DATA 371, 59, 195, 81, 92, 190, 106, 273, 60, 394,
      629, 270, 219, 106, 388
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1800 DATA 287, 63, 3, 6, 190, 122, 43, 233, 400, 106, 2
     90, 314, 47, 48, 81, 96
1810 DATA 26, 115, 92, 157, 190, 110, 77, 85, 196, 46,
     10, 113, 140, 353, 48
1820 DATA 120, 106, 2, 616, 61, 420, 822, 29, 125, 14,
     20, 37, 105, 28, 248
1830 DATA 16, 158, 7, 35, 19, 301, 125, 110, 496, 287,
     98, 117, 520, 62, 51
1840 DATA 219, 37, 113, 140, 818, 138, 549, 8, 44, 287,
      388, 117, 18, 79, 344
1850 DATA 34, 20, 59, 520, 557, 107, 612, 219, 37, 66,
     154, 41, 20, 50, 6, 584
1860 DATA 122, 154, 248, 110, 61, 52, 33, 30, 5, 38, 8,
      14, 84, 57, 549, 216
1870 DATA 115, 71, 29, 85, 63, 43, 131, 29, 138, 47, 73
     , 238, 549, 52, 53, 79
1880 DATA 118, 51, 44, 63, 195, 12, 238, 112, 3, 49, 79
     , 353, 105, 56, 371, 566
1890 DATA 210, 515, 125, 360, 133, 143, 101, 15, 284, 5
     49, 252, 14, 204, 140
1900 DATA 344, 26, 822, 138, 115, 48, 73, 34, 204, 316,
      616, 63, 219, 7, 52
1910 DATA 150, 44, 52, 16, 40, 37, 157, 818, 37, 121, 1
     2, 95, 10, 15, 35
1920 DATA 12, 131, 62, 115, 102, 818, 49, 53, 135, 138,
      30, 31, 62, 67, 41, 85
1930 DATA 63, 10, 106, 818, 138, 8, 113, 20, 32, 33, 37
     , 353, 287, 140, 47, 85
1940 DATA 50, 37, 49, 47, 64, 6, 7, 71, 33, 4, 43, 47,
     63, 1, 27, 609, 207
1950 DATA 229, 15, 190, 246, 85, 94, 520, 2, 270, 20, 3
     9, 7, 33, 44, 22, 40, 7
1960 DATA 10, 3, 822, 106, 44, 496, 229, 353, 210, 199,
      31, 10, 38, 140, 297
1970 DATA 61, 612, 320, 302, 676, 287, 2, 44, 33, 32, 5
     20, 557, 10, 6, 250
1980 DATA 566, 246, 53, 37, 52, 83, 47, 320, 38, 33, 81
     8, 7, 44, 30, 31, 250
1990 DATA 10, 15, 35, 106, 159, 113, 31, 102, 406, 229,
      549, 320, 29, 66, 33
2000 DATA 101, 818, 138, 301, 316, 353, 320, 219, 37, 5
     2, 28, 549, 320, 33, 8
2010 DATA 48, 107, 50, 822, 7, 2, 113, 73, 16, 125, 11,
      110, 67, 102, 818, 33
2020 DATA 59, 81, 157, 38, 43, 590, 138, 19, 85, 400, 3
     8, 43, 77, 14, 27, 8, 47
2030 DATA 138, 63, 140, 44, 35, 22, 176, 106, 250, 314,
      216, 2, 10, 7, 994
2040 DATA 4, 20, 25, 44, 48, 7, 26, 46, 110, 229, 818,
     190, 34, 112, 147, 44
2050 DATA 110, 121, 125, 96, 41, 51, 50, 140, 56, 47, 1
     52, 549, 63, 818, 28
2060 DATA 42, 250, 138, 591, 98, 653, 32, 107, 140, 112
     , 26, 85, 138, 549, 50
2070 DATA 20, 125, 371, 38, 36, 10, 52, 118, 136, 102,
     420, 150, 112, 71, 14
2080 DATA 20, 7, 24, 18, 12, 818, 37, 67, 110, 62, 33,
     21, 95, 219, 520, 102
2090 DATA 822, 30, 83, 84, 305, 629, 15, 2, 10, 8, 219,
      106, 353, 105, 106, 60
2100 DATA 242, 72, 8, 50, 204, 184, 112, 125, 549, 65,
     106, 818, 190, 96, 110
2110 DATA 16, 73, 33, 818, 150, 409, 400, 50, 154, 285,
      96, 106, 316, 270, 204
2120 DATA 101, 822, 400, 8, 44, 37, 52, 40, 240, 34, 20
     4, 38, 16, 46, 47, 85
2130 DATA 24, 44, 15, 64, 73, 138, 818, 85, 78, 110, 33
     , 420, 515, 53, 37, 38
2140 DATA 22, 31, 10, 110, 106, 101, 140, 15, 38, 3, 5,
      44, 7, 98, 287, 135
2150 DATA 150, 96, 33, 84, 125, 818, 190, 96, 520, 118,
      459, 370, 653, 466
2160 DATA 106, 41, 107, 612, 219, 275, 30, 150, 105, 49
     , 53, 287, 250, 207, 134
2170 DATA 7, 53, 12, 47, 85, 63, 138, 110, 21, 112, 140
     , 495, 496, 515, 14, 73
2180 DATA 85, 584, 994, 150, 199, 16, 42, 5, 4, 25, 42,
      8, 16, 822, 125, 159
2190 DATA 32, 204, 612, 818, 81, 95, 405, 41, 609, 136,
      14, 20, 28, 26, 353
2200 DATA 302, 246, 8, 131, 159, 140, 84, 440, 42, 16,
     822, 40, 67, 101, 102
2210 DATA 193, 138, 204, 51, 63, 240, 549, 122, 8, 10,
     63, 140, 47, 48, 140
2220 DATA 288, -1
2230 :
2240 :
2250 :
2260 REM{7 SPACEs}BEALE CODE --- PAPER THREE
2270 :
2280 DATA 317, 8, 92, 73, 112, 89, 67, 318, 28, 96, 107
     , 41, 631, 78, 146, 397
2290 DATA 118, 98, 114, 246, 348, 116, 74, 88, 12, 65,
     32, 14, 81, 19, 76, 121
2300 DATA 216, 85, 33, 66, 15, 108, 68, 77, 43, 24, 122
     , 96, 117, 36, 211, 301
2310 DATA 15, 44, 11, 46, 89, 18, 136, 68, 317, 28, 90,
      82, 304, 71, 43, 221
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232Ø DATA 198, 176, 31Ø, 319, 81, 99, 264, 38Ø, 56, 37,
     319, 2, 44, 53, 28, 44
233Ø DATA 75, 98, 1Ø2, 37, 85, 1Ø7, 117, 64, 88, 136, 4
     8, 151, 99, 175, 89, 315
234Ø DATA 326, 78, 96, 214, 218, 311, 43, 89, 51, 9Ø, 7
     5, 128, 96, 33, 28, 1Ø3
235Ø DATA 84, 65, 26, 41, 246, 84, 27Ø, 98, 116, 32, 59
     , 74, 66, 69, 24Ø, 15
236Ø DATA 8, 121, 2Ø, 77, 89, 31, 11, 1Ø6, 81, 191, 224
     , 328, 18, 75, 52, 82
237Ø DATA 117, 2Ø1, 39, 23, 217, 27, 21, 84, 35, 54, 1Ø
     9, 128, 49, 77, 88, 1
238Ø DATA 81, 217, 64, 55, 83, 116, 251, 269, 311, 96,
     54, 32, 12Ø, 18, 132
239Ø DATA 1Ø2, 219, 211, 84, 15Ø, 219, 275, 312, 64, 1Ø
     , 1Ø6, 87, 75, 47, 21
24ØØ DATA 29, 37, 81, 44, 18, 126, 115, 132, 16Ø, 181,
     2Ø3, 76, 81, 299, 314
241Ø DATA 337, 351, 96, 11, 28, 97, 318, 238, 1Ø6, 24,
     93, 3, 19, 17, 26, 6Ø
242Ø DATA 73, 88, 14, 126, 138, 234, 286, 297, 321, 365
     , 264, 19, 22, 84, 56
243Ø DATA 1Ø7, 98, 123, 111, 214, 136, 7, 33, 45, 4Ø, 1
     3, 28, 46, 42, 1Ø7, 196
244Ø DATA 227, 344, 198, 2Ø3, 247, 116, 19, 8, 212, 23Ø
     , 31, 6, 328, 65, 48, 52
245Ø DATA 59, 41, 122, 33, 117, 11, 18, 25, 71, 36, 45,
     83, 76, 89, 92, 31, 65
246Ø DATA 7Ø, 83, 96, 27, 33, 44, 5Ø, 61, 24, 112, 136,
     149, 176, 18Ø, 194, 143
247Ø DATA 171, 2Ø5, 296, 87, 12, 44, 51, 89, 98, 34, 41
     , 2Ø8, 173, 66, 9, 35
248Ø DATA 16, 95, 8, 113, 175, 9Ø, 56, 2Ø3, 19, 177, 18
     3, 2Ø6, 157, 2ØØ, 218
249Ø DATA 26Ø, 291, 3Ø5, 618, 951, 32Ø, 18, 124, 78, 65
     , 19, 32, 124, 48, 53
25ØØ DATA 57, 84, 96, 2Ø7, 244, 66, 82, 119, 71, 11, 86
     , 77, 213, 54, 82, 316
251Ø DATA 245, 3Ø3, 86, 97, 1Ø6, 212, 18, 37, 15, 81, 8
     9, 16, 7, 81, 39, 96
252Ø DATA 14, 43, 216, 118, 29, 55, 1Ø9, 136, 172, 213,
     64, 8, 227, 3Ø4, 611
253Ø DATA 221, 364, 819, 375, 128, 296
254Ø DATA 11, 18, 53, 76, 1Ø, 15, 23, 19, 71, 84, 12Ø,
     134, 66, 73, 89, 96, 23Ø
255Ø DATA 48, 77, 26, 1Ø1, 127, 936, 218, 439, 178, 171
     , 61, 226, 313, 215, 1Ø2
256Ø DATA 18, 167, 262, 114, 218, 66, 59, 48, 27, 19, 1
     3, 82, 48, 162, 119, 34
257Ø DATA 127, 139, 34, 128, 129, 74, 63, 12Ø, 11, 54,
     61, 73, 92, 18Ø, 66, 75
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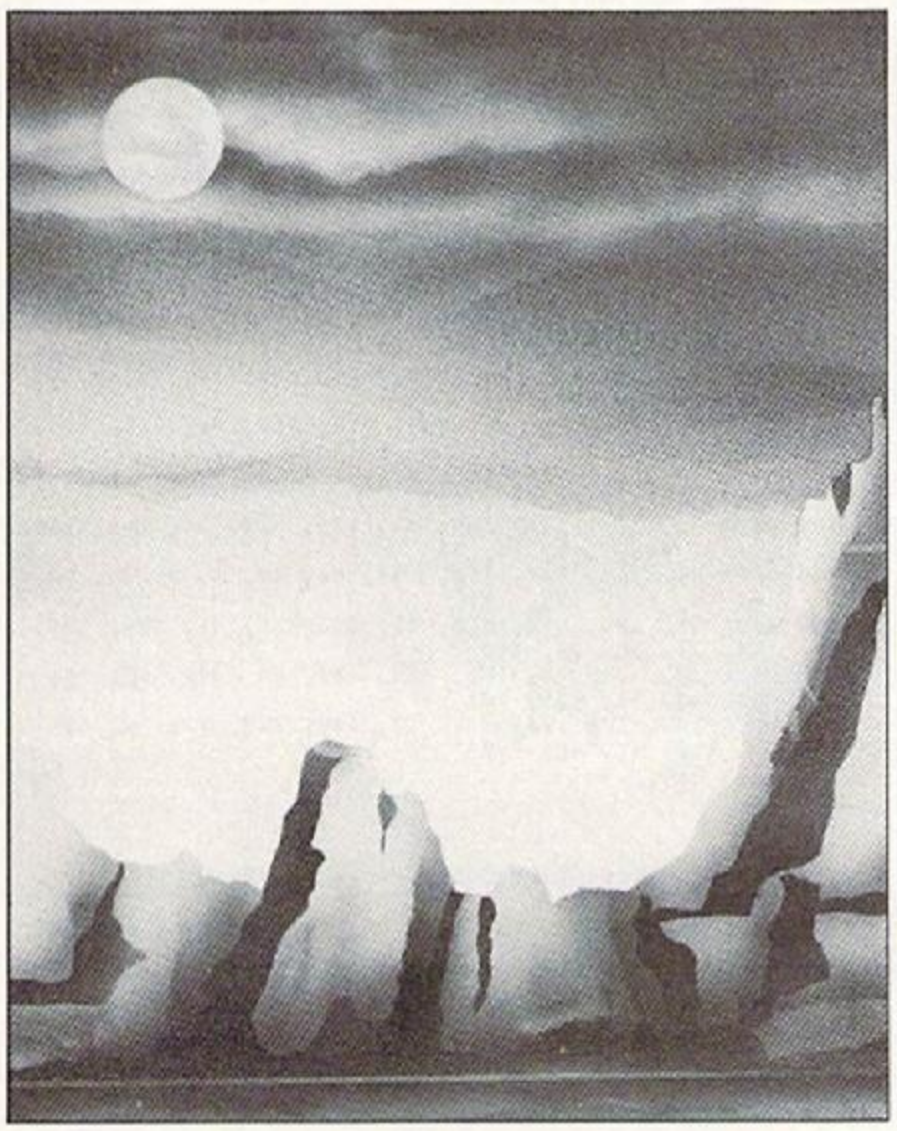

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2580 DATA 101, 124, 265, 89, 96, 126, 274, 896, 917, 43
     4, 461, 235, 890, 312
2590 DATA 413, 328, 381, 96, 105, 217, 66, 118, 22, 77,
      64, 42, 12, 7, 55, 24
2600 DATA 83, 67, 97, 109, 121, 135, 181, 203, 219, 228
     , 256, 21, 34, 77, 319
2610 DATA 374, 382, 675, 684, 717, 864, 203, 4, 18, 92,
      16, 63, 82, 22, 46, 55
2620 DATA 69, 74, 112, 135, 186, 175, 119, 213, 416, 31
     2, 343, 264, 119, 186
2630 DATA 218, 343, 417, 845, 951, 124, 209, 49, 617, 8
     56, 924, 936, 72, 19
2640 DATA 29, 11, 35, 42, 40, 66, 85, 94, 112, 65, 82,
     115, 119, 236, 244, 186
2650 DATA 172, 112, 85, 6, 56, 38, 44, 85, 72, 32, 47,
     73, 96, 124, 217, 314
2660 DATA 319, 221, 644, 817, 821, 934, 922, 416, 975,
     10, 22, 18, 46, 137, 181
2670 DATA 101, 39, 86, 103, 116, 138, 164, 212, 218, 29
     6, 815, 300, 412, 460
2680 DATA 495, 675, 820, 952, -1
2690 :
2700 :
2710 :
2720 :
2730 REM{7 SPACEs}DECLARATION OF INDEPENDENCE
2740 :
2750 DATA WHEN,IN,THE,COURSE,OF,HUMAN,EVENTS,IT,BECOMES
     ,NECESSARY,FOR,ONE
2760 DATA PEOPLE,TO,DISSOLVE,THE,POLITICAL,BANDS,WHICH,
     HAVE,CONNECTED,THEM,WITH
2770 DATA ANOTHER,AND,TO,ASSUME,AMONG,THE,POWERS,OF,THE
     ,EARTH,THE,SEPARATE,AND
2780 DATA EQUAL,STATION,TO,WHICH,THE,LAWS,OF,NATURE,AND
     ,OF,NATURES,GOD,ENTITLED
2790 DATA THEM,A,DECENT,RESPECT,TO,THE,OPINIONS,OF,MANK
     IND,REQUIRES,THAT,THEY
2800 DATA SHOULD,DECLARE,THE,CAUSES,WHICH,IMPEL,THEM,TO
     ,THE,SEPARATION,WE,HOLD
2810 DATA THESE,TRUTHS,TO,BE,SELF,EVIDENT,THAT,ALL,MEN,
     ARE,CREATED,EQUAL,THAT
2820 DATA THEY,ARE,ENDOWED,BY,THEIR,CREATOR,WITH,CERTAI
     N,UNALIENABLE,RIGHTS
2830 DATA THAT,AMONG,THESE,ARE,LIFE,LIBERTY,AND,THE,PUR
     SUIT,OF,HAPPINESS,THAT
2840 DATA TO,SECURE,THESE,RIGHTS,GOVERNMENTS,ARE,INSTIT
     UTED,AMONG,MEN,DERIVING
2850 DATA THEIR,JUST,POWERS,FROM,THE,CONSENT,OF,THE,GOV
     ERNED,THAT,WHENEVER,ANY
2860 DATA FORM,OF,GOVERNMENT,BECOMES,DESTRUCTIVE,OF,THE
     SE,ENDS,IT,IS,THE,RIGHT
2870 DATA OF,THE,PEOPLE,TO,ALTER,OR,TO,ABOLISH,IT,AND,T
     O,INSTITUTE,NEW
2880 DATA GOVERNMENT,LAYING,ITS,FOUNDATION,ON,SUCH,PRIN
     CIPLES,AND,ORGANIZING
2890 DATA ITS,POWERS,IN,SUCH,FORM,AS,TO,THEM,SHALL,SEEM
     ,MOST,LIKELY,TO,EFFECT
2900 DATA THEIR,SAFETY,AND,HAPPINESS,PRUDENCE,INDEED,WI
     LL,DICTATE,THAT
2910 DATA GOVERNMENTS,LONG,ESTABLISHED,SHOULD,NOT,BE,CH
     ANGED,FOR,LIGHT,AND
2920 DATA TRANSIENT,CAUSES,AND,ACCORDINGLY,ALL,EXPERIEN
     CE,HATH,SHOWN,THAT
2925 DATA MANKIND
2930 DATA ARE,MORE,DISPOSED,TO,SUFFER,WHILE,EVILS,ARE,S
     UFFERABLE,THAN,TO,RIGHT
2940 DATA THEMSELVES,BY,ABOLISHING,THE,FORMS,TO,WHICH,T
     HEY,ARE,ACCUSTOMED,BUT
2950 DATA WHEN,A,LONG,TRAIN,OF,ABUSES,AND,USURPATIONS,P
     URSUING,INVARIABLY,THE
2960 DATA SAME,OBJECT,EVINCES,A,DESIGN,TO,REDUCE,THEM,U
     NDER,ABSOLUTE,DESPOTISM
2970 DATA IT,IS,THEIR,RIGHT,IT,IS,THEIR,DUTY,TO,THROW,O
     FF,SUCH,GOVERNMENT,AND
2980 DATA TO,PROVIDE,NEW,GUARDS,FOR,THEIR,FUTURE,SECURI
     TY,SUCH,HAS,BEEN,THE
2990 DATA PATIENT,SUFFERANCE,OF,THESE,COLONIES,AND,SUCH
     ,IS,NOW,THE,NECESSITY
3000 DATA WHICH,CONSTRAINS,THEM,TO,ALTER,THEIR,FORMER,S
     YSTEMS,OF,GOVERNMENT,THE
3010 DATA HISTORY,OF,THE,PRESENT,KING,OF,GREAT,BRITAIN,
     IS,A,HISTORY,OF,REPEATED
3020 DATA INJURIES,AND,USURPATIONS,ALL,HAVING,IN,DIRECT
     ,OBJECT,THE
3030 DATA ESTABLISHMENT,OF,AN,ABSOLUTE,TYRANNY,OVER,THE
     SE,STATES,TO,PROVE,THIS
3040 DATA LET,FACTS,BE,SUBMITTED,TO,A,CANDID,WORLD,HE,H
     AS,REFUSED,HIS,ASSENT
3050 DATA TO,LAWS,THE,MOST,WHOLESOME,AND,NECESSARY,FOR,
     THE,PUBLIC,GOOD,HE,HAS
3060 DATA FORBIDDEN,HIS,GOVERNORS,TO,PASS,LAWS,OF,IMMED
     IATE,AND,PRESSING
3070 DATA IMPORTANCE,UNLESS,SUSPENDED,IN,THEIR,OPERATIO
     N,TILL,HIS,ASSENT,SHOULD
3080 DATA BE,OBTAINED,AND,WHEN,SO,SUSPENDED,HE,HAS,UTTE
     RLY,NEGLECTED,TO,ATTEND
3090 DATA TO,THEM,HE,HAS,REFUSED,TO,PASS,OTHER,LAWS,FOR
     ,THE,ACCOMMODATION,OF
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3100 DATA LARGE,DISTRICTS,OF,PEOPLE,UNLESS,THOSE,PEOPLE
     ,WOULD,RELINQUISH,THE
3110 DATA RIGHT,OF,REPRESENTATION,IN,THE,LEGISLATURE,A,
     RIGHT,INESTIMABLE,TO
3120 DATA THEM,AND,FORMIDABLE,TO,TYRANTS,ONLY,HE,HAS,CA
     LLED,TOGETHER
3130 DATA LEGISLATIVE,BODIES,AT,PLACES,UNUSUAL,UNCOMFOR
     TABLE,AND,DISTANT,FROM
3140 DATA THE,DEPOSITORY,OF,THEIR,PUBLIC,RECORDS,FOR,TH
     E,SOLE,PURPOSE,OF
3150 DATA FATIGUING,THEM,INTO,COMPLIANCE,WITH,HIS,MEASU
     RES,HE,HAS,DISSOLVED
3160 DATA REPRESENTATIVE,HOUSES,REPEATEDLY,FOR,OPPOSING
     ,WITH,MANLY,FIRMNESS
3170 DATA HIS,INVASIONS,ON,THE,RIGHTS,OF,THE,PEOPLE,HE,
     HAS,REFUSED,FOR,A,LONG
3180 DATA TIME,AFTER,SUCH,DISSOLUTIONS,TO,CAUSE,OTHERS,
     TO,BE,ELECTED,WHEREBY
3190 DATA THE,LEGISLATIVE,POWERS,INCAPABLE,OF,ANNILIATI
     ON,HAVE,RETURNED,TO,THE
3200 DATA PEOPLE,AT,LARGE,FOR,THEIR,EXERCISE,THE,STATE,
     REMAINING,IN,THE
3210 DATA MEANTIME,EXPOSED,TO,ALL,THE,DANGERS,OF,INVASI
     ON,FROM,WITHOUT,AND
3220 DATA CONVULSIONS,WITHIN,HE,HAS,ENDEAVORED,TO,PREVE
     NT,THE,POPULATION,OF
3230 DATA THESE,STATES,FOR,THAT,PURPOSE,CONSTRUCTING,TH
     E,LAWS,OF,NATURALIZATION
3240 DATA OF,FOREIGNERS,REFUSING,TO,PASS,OTHERS,TO,ENCO
     URAGE,THEIR,MIGRATION
3250 DATA HITHER,AND,RAISING,THE,CONDITIONS,OF,NEW,APPR
     OPRIATIONS,OF,LANDS
3260 DATA HE,HAS,OBSTRUCTED,THE,ADMINSTRATION,OF,JUSTIC
     E,BY,REFUSING,HIS
3270 DATA ASSENT,TO,LAWS,FOR,ESTABLISHING,JUDICIARY,POW
     ERS,HE,HAS,MADE,JUDGES
3280 DATA DEPENDENT,ON,HIS,WILL,ALONE,FOR,THE,TENURE,OF
     ,THEIR,OFFICES,AND,THE
3290 DATA AMOUNT,AND,PAYMENT,OF,THEIR,SALARIES,HE,HAS,E
     RECTED,A,MULTITUDE,OF
3300 DATA NEW,OFFICES,AND,SENT,HITHER,SWARMS,OF,OFFICER
     S,TO,HARASS,OUR,PEOPLE
3310 DATA AND,EAT,OUT,THEIR,SUBSTANCE,HE,HAS,KEPT,AMONG
     ,US,IN,TIMES,OF,PEACE
3320 DATA STANDING,ARMIES,WITHOUT,THE,CONSENT,OF,OUR,LE
     GISLATURE,HE,HAS
3330 DATA AFFECTED,TO,RENDER,THE,MILITARY,INDEPENDENT,O
     F,AND,SUPERIOR,TO,THE
3340 DATA CIVIL,POWER,HE,HAS,COMBINED,WITH,OTHERS,TO,SU
     BJECT,US,TO,A
3350 DATA JURISDICTION,FOREIGN,TO,OUR,CONSTITUTION,AND,
     UNACKNOWLEDGED,BY,OUR
3360 DATA LAWS,GIVING,HIS,ASSENT,TO,THEIR,ACTS,OF,PRETE
     NDED,LEGISLATION,FOR
3370 DATA QUARTERING,LARGE,BODIES,OF,ARMED,TROOPS,AMONG
     ,US,FOR,PROTECTING,THEM
3380 DATA BY,A,MOCK,TRIAL,FROM,PUNISHMENT,FOR,ANY,MURDE
     RS,WHICH,THEY,SHOULD
3390 DATA COMMIT,ON,THE,INHABITANTS,OF,THESE,STATES,FOR
     ,CUTTING,OFF,OUR,TRADE
3400 DATA WITH,ALL,PARTS,OF,THE,WORLD,FOR,IMPOSING,TAXE
     S,ON,US,WITHOUT,OUR
3410 DATA CONSENT,FOR,DEPRIVING,US,IN,MANY,CASES,OF,THE
     ,BENEFITS,OF,TRIAL,BY
3420 DATA JURY,FOR,TRANSPORTING,US,BEYOND,SEAS,TO,BE,TR
     IED,FOR,PRETENDED
3430 DATA OFFENCES,FOR,ABOLISHING,THE,FREE,SYSTEM,OF,EN
     GLISH,LAWS,IN,A
3440 DATA NEIGHBORING,PROVINCE,ESTABLISHING,THEREIN,AN,
     ARBITRARY,GOVERRNMENT
3450 DATA AND,ENLARGING,ITS,BOUNDARIES,SO,AS,TO,RENDER,
     IT,AT,ONCE,AN,EXAMPLE
3460 DATA AND,FIT,INSTRUMENT,FOR,INTRODUCING,THE,SAME,A
     BSOLUTE,RULE,IN,THESE
3470 DATA COLONIES,FOR,TAKING,AWAY,OUR,CHARTERS,ABOLISH
     ING,OUR,MOST,VALUABLE
3480 DATA LAWS,AND,ALTERING,FUNDAMENTLLY,THE,FORMS,OF,O
     UR,GOVERNMENTS,FOR
3490 DATA SUSPENDING,OUR,OWN,LEGISLATURE,AND,DECLARING,
     THEMSELVES,INVESTED
3500 DATA WITH,POWER,TO,LEGISLATE,FOR,US,IN,ALL,CASE,WH
     ATSOEVER,HE,HAS
3510 DATA ABDICATED,GOVERNMENT,HERE,BY,DECLARING,US,OUT
     ,OF,HIS,PROTECTION,AND
3520 DATA WAGING,WAR,AGAINST,US,HE,HAS,PLUNDERED,OUR,SE
     AS,RAVAGED,OUR,COASTS
3530 DATA BURNT,OUR,TOWNS,AND,DESTROYED,THE,LIVES,OF,OU
     R,PEOPLE,HE,IS,AT,THIS
3540 DATA TIME,TRANSPORTING,LARGE,ARMIES,OF,FOREIGN,MER
     CENARIES,TO,COMPLEAT
3550 DATA THE,WORKS,OF,DEATH,DESOLATION,AND,TYRANNY,ALR
     EADY,BEGUN,WITH
3560 DATA CIRCUMSTANCES,OF,CRUELTY,&,PERFIDY,SCARCELY,P
     ARALLELED,IN,THE,MOST
3570 DATA BARBAROUS,AGES,AND,TOTALLY,UNWORTHY,THE,HEAD,
     OF,A,CIVILIZED,NATION
3580 DATA HE,HAS,CONSTRAINED,OUR,FELLOW,CITIZENS,TAKEN,
     CAPTIVE,ON,THE,HIGH,SEAS
3590 DATA TO,BEAR,ARMS,AGAINST,THEIR,COUNTRY,TO,BECOME,
     THE,EXECUTIONERS,OF
3600 DATA THEIR,FRIENDS,AND,BRETHERN,OR,TO,FALL,THEMSEL
     VES,BY,THEIR,HANDS,HE
3610 DATA HAS,EXCITED,DOMESTICE,INSURRECTIONS,AMONGST,U
     S,AND,HAS,ENDEAVORED,TO
3620 DATA BRING,ON,THE,INHABITANTS,OF,OUR,FRONTIERS,THE
     ,MERCILESS,INDIAN
3630 DATA SAVAGES,WHOSE,KNOWN,RULE,OF,WARFARE,IS,AN,UND
     ISTINGUISHED
3640 DATA DESTRUCTION,OF,ALL,AGES,SEXES,AND,CONDITIONS,
     IN,EVERY,STAGE,OF
3650 DATA THESE,OPPRESSIONS,WE,HAVE,PETITIONED,FOR,REDR
     ESS,IN,THE,MOST,HUMBLE
3660 DATA TERMS,OUR,REPEATED,PETITIONS,HAVE,BEEN,ANSWER
     ED,ONLY,BY,REPEATED
3670 DATA INJURY,A,PRINCE,WHOSE,CHARACTER,IS,THUS,MARKE
     D,BY,EVERY,ACT,WHICH,MAY
3680 DATA DEFINE,A,TYRANT,IS,UNFIT,TO,BE,THE,RULER,OF,A
     ,FREE,PEOPLE,NOR,HAVE
3690 DATA WE,BEEN,WANTING,IN,ATTENTIONS,TO,OUR,BRITISH,
     BRETHERN,WE,HAVE
3700 DATA WARNED,THEM,FROM,TIME,TO,TIME,OF,ATTEMPTS,BY,
     THEIR,LEGISLATURE,TO
3710 DATA EXTEND,AN,UNWARRANTABLE,JURISDICTION,OVER,US,
     WE,HAVE,REMINDED,THEM
3720 DATA OF,THE,CIRCUMSTANCES,OF,OUR,EMIGRATION,AND,SE
     TTLEMENT,HERE,WE,HAVE
3730 DATA APPEALED,TO,THEIR,NATIVE,JUSTICE,AND,MAGNANIM
     ITY,AND,WE,HAVE
3740 DATA CONJURED,THEM,BY,THE,TIES,OF,OUR,COMMON,KINDR
     ED,TO,DISAVOW,THESE
3750 DATA USURPATIONS,WHICH,WOULD,INEVITABLY,INTERRUPT,
     OUR,CONNECTIONS,AND
3760 DATA CORRESPONDENCE,THEY,TOO,HAVE,BEEN,DEAF,TO,THE
     ,VOICE,OF,JUSTICE,AND,OF
3770 DATA CONSANGUINITY,WE,MUST,THEREFORE,ACQUIESCE,IN,
     THE,NECESSITY,WHICH
3780 DATA DENOUNCES,OUR,SEPARATION,AND,HOLD,THEM,AS,WE,
     HOLD,THE,REST,OF
3790 DATA MANKIND,ENEMIES,IN,WAR,IN,PEACE,FRIENDS,WE,TH
     EREFORE,THE
3800 DATA REPRESENTATIVES,OF,THE,UNITED,STATES,OF,AMERI
     CA,IN,GENERAL,CONGRESS
3810 DATA ASSEMBLED,APPEALING,TO,THE,SUPREME,JUDGE,OF,T
     HE,WORLD,FOR,THE
3820 DATA RECTITUDE,OF,OUR,INTENTIONS,DO,IN,THE,NAME,AN
     D,BY,AUTHORITY,OF
3830 DATA THE,GOOD,PEOPLE,OF,THESE,COLONIES,SOLEMNLY,PU
     BLISH,AND,DECLARE,THAT
3840 DATA THESE,UNITED,COLONIES,ARE,AND,OF,RIGHT,OUGHT,
     TO,BE,FREE,AND
3850 DATA INDEPENDENT,STATES,THAT,THEY,ARE,ABSOLVED,FRO
     M,ALL,ALLEGIANCE,TO,THE
3860 DATA BRITISH,CROWN,AND,THAT,ALL,POLITICAL,CONNECTI
     ON,BETWEEN,THEM,AND,THE
3870 DATA STATE,OF,GREAT,BRITAIN,IS,AND,OUGHT,TO,BE,TOT
     ALLY,DISSOLVED,AND,THAT
3880 DATA AS,FREE,AND,INDEPENDENT,STATES,THEY,HAVE,FULL
     ,POWER,TO,LEVY,WAR
3890 DATA CONCLUDE,PEACE,CONTRACT,ALLIANCES,ESTABLISH,C
     OMMERCE,AND,TO,DO,ALL
3900 DATA OTHER,ACTS,AND,THINGS,WHICH,INDEPENDENT,STATE
     S,MAY,OF,RIGHT,DO,AND
3910 DATA FOR,THE,SUPPORT,OF,THIS,DECLARATION,WITH,A,FI
     RM,RELIANCE,ON,THE
3920 DATA PROTECTION,OF,DIVINE,PROVIDENCE,WE,MUTUALLY,P
     LEDGE,TO,EACH,OTHER,OUR
3930 DATA LIVES,OUR,FORTUNES,AND,OUR,SACRED,HONOR
3940 DATA NNNNNNNNNN
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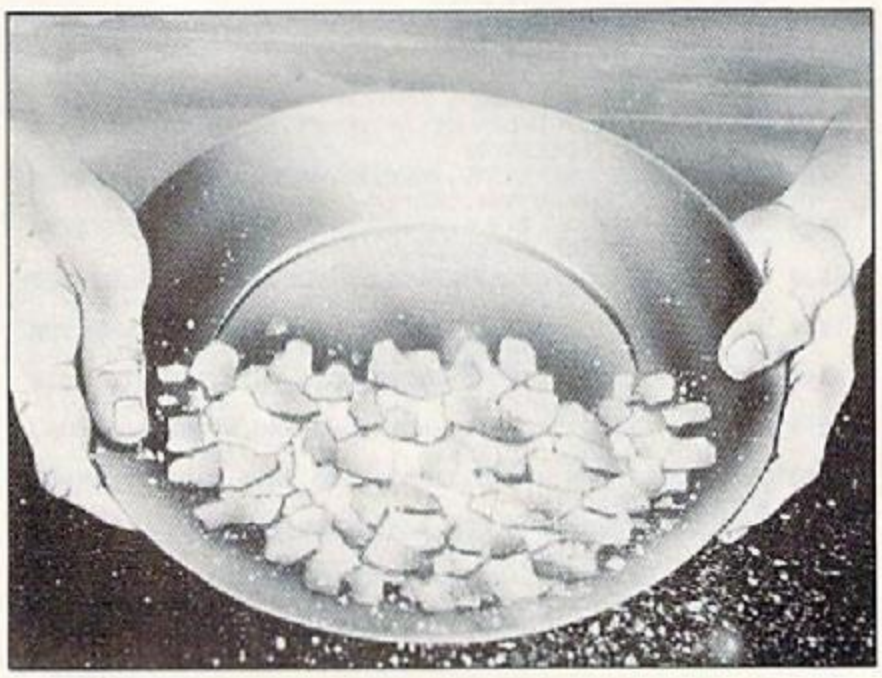

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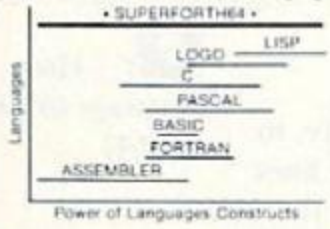

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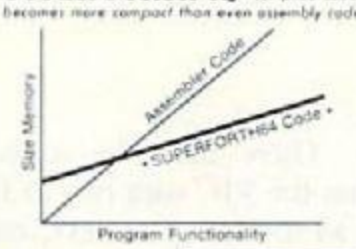

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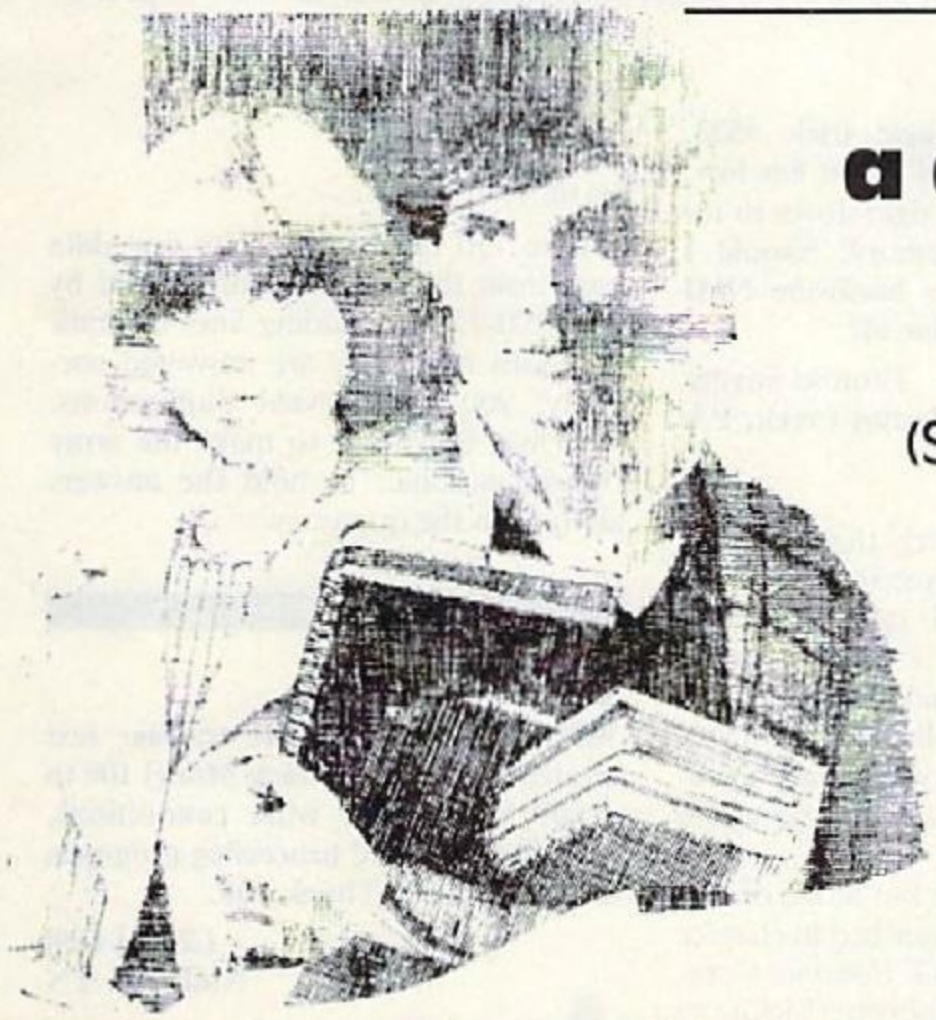

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(from page 12)

insert a line to open a file to the printer, such as:

```
10 OPEN 4,4
```

Finally, add a close statement, such as 990 CLOSE 4 just before the end of your program.

After doing this, your program will print to the printer instead of the screen. If you want it to appear temporarily on the screen, just change the second 4 in the Open statement to 3, and you'll be using the screen again. Some books tell you to use the CMD command instead of the above, but there are many problems with that approach, and I do *not* recommend it for anything but making program listings.

Q: There must be some way to program the VIC with two or three lines to use all the function keys, rather than having to use two or three lines for each key.

Denny Jakoubek
Garner, IA

A: Here's a three-liner for you:

```
100 GET A$:IF A$="" THEN 100
110 ON ASC(A$)-132 GOSUB 200,300,400,
    500,600,700,800,900
120 GOTO 100
```

If you press F1, the program will branch to line 200. If you press F2, it will go to line 300 and so on. Each section should end with something like 290 RETURN to bring the program back to watch the function keys again.

One nice aspect of this method is that keys other than F1-F8 will simply fall through to line 120, thus effectively being ignored.

Q: Is there any way to get something printed with both upper- and lowercase letters?

Mike Manning
Sauk Village, IL

A: Yes, but the method depends on the device in question. To shift to Text mode (lower- and uppercase) on the screen, press the Commodore key while holding down the shift key. To output text to a Commodore serial bus printer, such as the 1525, open your file to it with a secondary address of seven (i.e., OPEN 4,4,7).

If you have an IEEE-488 bus Commodore printer, you need to open two files to the printer, one to secondary address seven and the other not. For example:

```
100 OPEN 7,4,7
110 PRINT #7
120 OPEN 4,4
```

Don't forget to close both files when you are done with them.

If you have a non-Commodore printer, you'll need an interface able to convert the Commodore character codes (PETSCII) into those used by the printer (usually ASCII).

Q: How can I know the machine language to program my own games on the 64?

Joseph Bober
Brooklyn, NY

A: Keep reading *RUN*, join a user's group and take a class. But don't forget Basic; many fine games have been written in it.

Q: Regarding Magic trick #$33. Whenever I take my 64's reset line low, I get a *complete* reset, right down to totally clearing user memory! Should I continue to develop a hardware NMI switch, or is my machine ill?

Thomas Snyder
Martins Creek, PA

A: It's most unlikely that your machine is ill. While I agree that your machine's memory will *appear* cleared after a reset, it isn't actually. Though Basic programs you had in memory will no longer list, they will still be in memory. The trick is that you'll have to restore the pointers that tell Basic where your program is.

Doing so is beyond the scope of this column, but is fully described in chapter 8 of my book *The PET Personal Computer Guide*, from Osborne/McGraw-Hill. (Just remember your pointers are three locations after those of the PET, and your text area is at $0800, not $0400.) You'll also need a machine language monitor, available from most dealers and user groups.

Similarly, machine language programs or Poked data that you had in safe memory locations, such as from $C000–CFFF hexadecimal, will still be there unchanged after a reset. Don't bother making a hardware NMI switch for the 64; it would simply duplicate the restore key already on your keyboard. (See last month's Magic column, trick #$8C, for Louis Sander's clarification of trick #$33.)

Q: I want to read Data statements randomly, so questions can be asked in a different order.

Raymond Allen
Cortez, FL

A: Reading Data statements in random order is difficult, but selecting questions randomly is quite simple. Just read all the questions into a string array, and then randomly select which array element to use next. For example:

```
100 FOR I=0 TO 9
110 : READ A$(I)
120 NEXT
130 DATA 0,1,2,3,4,5,6,7,8,9
140 FOR I=0 TO 9
150 : ? A$(RND(0)*10)
160 NEXT
```

Line 150 randomly selects one data item from the ten in the array read by lines 100–120. By adding lines to mark questions after they are answered correctly, you can prevent duplications. You may also want to make the array two-dimensional, to hold the answers along with the questions.

Other

Q: How would one transfer text created on a Radio Shack Model 100 to a 64? Specifically, what connections, modems and word processing programs should be used? Thank you.

Gilbert Gall
Nashville, TN

A: First, you'll need Commodore's 1011-A RS-232 interface (or an equivalent). You'll also need to swap RS-232 lines 2 and 3 inside the interface or add a null modem adapter to do the same thing. Then connect the Tandy

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100's serial port to the 1011A via an RS-232 cable with DB-25S (male) connectors at both ends. Radio Shack and other electronic stores will have suitable cables and adapters.

Next, you'll need a suitable terminal program for the 64. As mentioned last month, I use Telstar 64 from Eastern House Software for this chore. To establish communication between the Tandy and the 64, start Telstar and use its @ command to set it to 300 baud, 8 bits, no parity and 1 stop bit.

Also select H, for Half Duplex mode. Then set the Tandy's Telcom program to STAT 38N1E, go to Terminal mode and select Half Duplex. At this point, anything appearing on either screen will also appear on the other one.

To transfer files, first open a file on Telstar, using the W command, specifying PET ASCII as the file type. Then exit to Terminal mode. Now press the return key twice on the Tandy and select UPLOAD, pressing the return key again when it asks for the width. Your file will then begin appearing on the 64's screen and will be buffered into memory at the same time.

When the Tandy stops sending, be sure to use Telstar's C (close) command, followed by W for write. This will dump the memory buffer into the disk file and close it properly.

Finally, to use the new file on the 64, I use the Paper Clip word processor from Batteries Included. Its Control-J File Load command handles everything.

The entire process is very reliable, takes much less time to do than to describe and can be reversed to send files from the 64 to the Tandy.

Q: I would like to write a Cobol compiler and other software. Where can I obtain technical information on the Commodore 64's operating system?

Gordon Bates
Council Bluffs, IA

A: A short list of serious and trustworthy software developers have retrieved such information directly from Commodore in the past. If you qualify, Commodore might be interested in hearing from you. If Commodore doesn't help you, Abacus Software of Grand Rapids, MI, offers a good book on the subject, called *Anatomy of the Commodore 64*. I, for one, would be interested in a Cobol compiler for the 64 that doesn't need the CP/M card.

Q: On several occasions in reading *RUN*, I have come across the phrase "copy-protected disk." What does this mean?

R. Gangadharan
Flushing, NY

A: It is a polite way of saying a disk has been altered to make it difficult to duplicate. The purpose is to keep people from giving away copies of the programs on the disk. Many such programs force the disk into an intentional error every time they are started.

Unfortunately, efforts by the drive to recover from the error cause some 1541s

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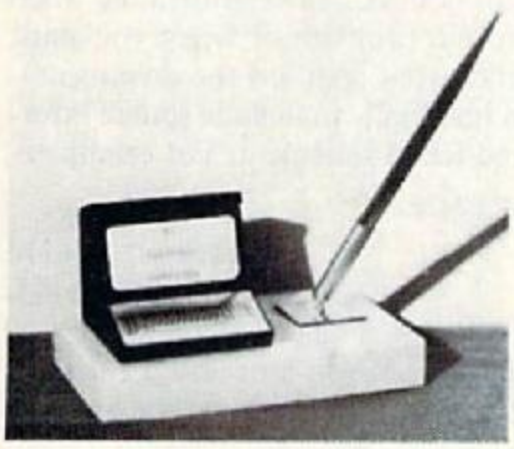

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to go out of alignment. It is to your advantage to avoid such programs, even if you are honest (as I hope you are).

Q: We have a PET Emulator program that we had hoped to use with cassette tapes from our PET 4016 and 4032, but we now have Commodore 64s. After numerous attempts, we can use very few of the old programs, as they do not load on the 64s.

Is it possible that the tapes won't load because the cassette is from a different model, and therefore the emulator won't work?

Mrs. B. Klemm
Bloomingdale, NJ

A: There are some differences in the three different cassette recorders used by Commodore over the years, and in the computers' use of the cassettes. But your 64s should be able to read a PET cassette.

If they don't, indicated by a Load Error message after trying and failing, try again, using the same Datassette that originally recorded the cassette. Also, be sure the Datassette and its cord are as far away from televisions and other sources of interference as possible.

If the program is found, and the computer returns to the Ready mode without an error message, your problem probably isn't in the Datassette. The emulator was only intended to handle Basic programs, so some machine language games and aids won't work with it.

Update: Readers Michael Keryan and John Streitt report the restore key is different from all others on the keyboard. Its controlling circuit requires a sudden change from the key to couple enough signal to trigger its timer. This means the key must be pressed quickly (which is not the same thing as firmly) before it will register.

Don't bother cleaning your keyboard unless a quick tap of the restore key while holding down the stop key fails to activate the restore function. R

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(from p. 16)

on the screen, type RUN and hit the return key. Remember, if the Run command is on the last line, it will scroll everything up one line.

This program works well when added to "Spriten Up!" (*RUN*, February 1984) to make a hard copy of the sprites you design.

David Lutz
Cave Creek, AZ

$BA Random numbers—Type in the following program and run it a few times. Each time you run the program, write down the numbers. Now turn off your computer and do it again. You might be surprised by the results, which show an identical sequence of numbers each time.

```
10 FOR A=1 TO 6 : B=INT(RND(1)*100) : PRINT B : NEXT
```

Change the RND(1) to RND(0), then repeat all your steps. You'll see that a zero value in RND's argument makes for a lot more randomness. Positive values should be used as arguments for RND only when you want the series of numbers to repeat, as in testing a program.

Ian Lauder
Kalispell, MT

$BB Input hint—The ominous appearance of ?REDO FROM START can be unsettling to the user who doesn't realize that the computer merely wants numeric rather than string input (or vice versa). The following routine allows a program to accept inputs in either form, displaying them in a chosen format. The technique permits flexibility in data entry, while ensuring that the output is standardized.

```
100 INPUT "MONTH";M$
110 FOR M=1 TO 13 : READ MO$
120 IF LEFT$(M$,3)=MO$ THEN 150
130 IF VAL(M$)=M THEN 150
140 NEXT
150 PRINT MO$
160 PRINT:RESTORE:GOTO100
170 DATA JAN,FEB,MAR,APR,MAY,JUN,JUL,AUG,SEP,OCT,
    NOV,DEC,???
```

In my example, months can be entered in numeric or alphabetic form and abbreviated or spelled in full, and the program returns their three-letter abbreviations. Simple changes will make the program return the numeric form of the month, or even its fully spelled name. Of course, the technique isn't limited to months of the year, but can be used in a wide variety of situations.

Eddie Johnsom
Albuquerque, NM

$BC GET trick—Sometimes you might want to display a screen for a certain length of time by using a For...Next loop. But other times you may not want to waste time waiting for the loop to end. The following code allows a pre-timed wait to be terminated by a keypress.

```
100 FOR I=1 TO 500 : GET A$ : IF A$="" THEN NEXT
110 Continuation goes here.
```

Stan Tomasevich
Lexington, KY

$BD For...Next tip—When using Basic, you must be very careful with the following.

```
10 FOR H=1 TO 20
20 NEXT H
30 PRINT H
```

The final output, which you might expect to be 20, will be 21. Not only will that value be printed, but every time H is called, until it is changed, the value 21 will be returned.

Russell P. Marsella
Lincoln, RI

$BE REMarkable idea—As your program collection grows, it becomes impossible to remember where you got each program. This, of course, can be frustrating when you must know who wrote a program or when you must look up the magazine article that contains the documentation. A simple solution is habitually to include source information in a low-numbered REM statement. For example:

```
0 REM ** RUN, AUGUST 84, PAGE 10 **
```

Charles L. Moore
Fairfield, AL

$BF Screen Poke hint—When you assign variables to the screen position of a character, and use the common

```
S = X + [screen width] * Y
```

the X and Y take 14 bytes of memory, and the math slows down the computer.

Instead, use only one variable, for example, S. Add or subtract one to move horizontally, and add or subtract (screen width) to move vertically. It's faster, and it can save needed memory in a small VIC. The screen width is, of course, 22 in a VIC and 40 in a C-64.

Timothy C. Shea
Burlington, VT

$CO Custom character trick—When using custom characters on the VIC, you can also use the regular characters at will, just by printing their reversed versions. To prove it, type in POKE 36869,255 to get into Custom Character mode.

As you subsequently press keys, you'll see whatever random RAM patterns make up your pseudo-custom char-

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acters. Now press {CTRL 9} to put the VIC into Reverse mode, and notice that the keys print their normal characters.

Joseph Chan
Barrington, RI

$C1 Reverse field hint—When working on a program that uses reversed lettering, you don't have to use the CTRL 9 reverse field symbol inside quotes to enable the Reverse Field mode. POKE 199,1 will cause the subsequent printing to be in reverse field. POKE 199,0 will undo the reverse, as will printing a return.

Paul James
Cleveland, TN

$C2 Lining up numbers—There are many ways to format numbers, which in the noncomputer world are always lined up according to the position of their decimal points, but which computers love to left justify. The following is a simple program to align the decimal points in numbers containing from one to three digits:

```
10 FOR I=9 TO 109 STEP 50
20 PRINT SPC(ABS(I<100)) SPC(ABS(I<10)) I
30 NEXT I
```

This is useful when printing highly variable numbers to a particular screen location and, of course, when printing out columns of numbers.

Roy E. Kannaday, Jr.
Littleton, CO

$C3 Joystick trickery—With an Atari-style joystick in port 1, you can slow down screen printing by moving the joystick to the left. This duplicates the action of the CTRL key and is very useful when reading long program listings.

Mike Zuerlein
Casper, WY

$C4 Typing tip—If you are a one-handed typist, you know that it's difficult to use the CTRL RVS key, because it slows you down. Well, now you need only one hand, and you don't have to stretch clear across the keyboard.

Just press the CTRL and R keys. It works in or out of Quote mode, and it's very handy if you are using your hand to spot text on a listing.

Doug Hanley
Las Vegas, NV

$C5 Keyboard tip—If you've just accidentally deleted a line and the full line is still on the screen, just move the cursor up to the line number and press the return key. The line will be added back into the current program in memory, at the appropriate position.

Glenn Davison
Aurora, CO

$C6 Moving program lines—If you need to move a line from one place in a program to another, first list the line you wish to move; next, move the cursor up to the line number and type the new line number over the old one; then press the return key. Finally, delete the original line by typing only the line number and pressing the return key.

Caution: If the new line number is longer than the original line number and its following space, you'll have to add spaces to the beginning of the line before you type in the new line number. The original line will automatically return to its original format.

Glenn Davison
Aurora, CO

$C7 Entering long lines—Entering the 80th character on a C-64 program line (or the 88th on a VIC line) can be mighty frustrating. As soon as you type it in, the cursor jumps down to the next line, where pressing the return key fails to enter what you just typed.

There are two ways around the problem. The first is simply to move your cursor back to the program line, then press the return key. The second is to leave out some character short of the 80th, such as character number 75. Then, after you're done with number 80, the cursor will still be on the line you want. Just move it back to where you left out the character, use the insert key to open up a space and type in the missing character. Then, when you press the return key, the line will be entered perfectly into memory.

Philip J. Ternes
Bismark, ND

$C8 Flagrant patriotism—Enter this one-liner:

```
1 PRINT "{2 spaces}{CTRL R}{CTRL 1}{11 spaces}{CTRL 8}
  {12 spaces}{CTRL 3}{11 spaces}":POKE 53280,1:POKE53281,1:
  GOTO1
```

Now run the program, count to ten and press the stop key. Then use your cursor controls and the space bar to wipe out the Break and Ready messages. Press [CTRL 2] and see the flag of Belgium. Anyone for the Union Jack?

R. Rock
Montgomery, AL

$C9 Binary to decimal converter—This one-liner will handle any length number you wish to input. In addition, if you change the *2↑X in the middle of the line to *8↑X it will handle any length octal number. (To fit the converter on one line, you must abbreviate most of its keywords.)

```
2A=1:FORX=LEN(B$)-1TO1STEP-1:D=D+(VAL(MID$(B$,A,
1)))*2↑XA=A+1:NEXT:D=D+VAL(RIGHT$(B$,1))
```

Adding the following two lines gives you a working routine.

```
1 INPUT"BINARY #";B$
3 PRINT D
```

Frank Williams
Tucson, AZ

$CA Choosing—To allow easy choice of either keyboard or joystick input, you can use the following method. First, insert line 100 during the start of the game.

```
100 P=1: INPUT "JOYSTICK (J) OR KEYBOARD (K)";A$:
    IF A$="K" THEN P=2
```

In a single line, you have requested input, limited the value of P to either 1 or 2 and set a default value of P=1 if any key other than K is pressed.

To check for movement, simply insert line 200.

```
200 ON P GOSUB 50,75
```


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Here the joystick subroutine lies at line 50 and the keyboard subroutine starts at line 75. Line 200 is an often-overlooked form of branching, yet it uses less space than the usually encountered

```
200 IF P=1 GOSUB 50
210 IF P=2 GOSUB 75
```

Note that by placing the invoked subroutines near the beginning of the program, you'll speed up the execution time, which is important for subroutines called as often as these usually are.

Steve Hite
Metairie, LA

$CB Binary one-liner—This lists the binary number sequence from 0000 to 1111 using nested loops. The number of loops can be changed for the required number of bits, which may increase the number of program lines. The program is:

```
10 FORA=0TO1:FORB=0TO1:FORC=0TO1:FORD=0TO1:
   PRINTA;B;C;D:NEXT:NEXT:NEXT:NEXT
```

Lee G. Halphen
Opelousas, LA

$CC Operating tip—Write any numbers you use repeatedly on a wee piece of masking tape and stick them to the top of your keyboard. (Now let's see. . . is it SYS49152 or SYS49512? Let me consult my wee tape!)

Marian Hatch
Las Lunas, NM

$CD Naming programs—When you write a long program, it's a good idea to use a short name on the disk until you finish the program. It's faster and easier to type in a short program name. You can rename it after you finish the program.

Jimmy Burrows
Cheyenne, OK

$CE Data file titles—When you search through a cassette using the Verify command, and try to find a certain program or data file, you're unable to differentiate between them because the computer displays each on the screen in the same way. This makes it impossible to know which are programs and which are files.

One solution is to save programs as before, but to write data files with titles in reverse characters. For example:

```
OPEN 1,1,1,"(RVS ON) name of file"
```

Then, when you search through a cassette, program names are in normal type and data files are in reverse characters.

Jim E. Newton
Mississippi State, MS

$CF Word trick—In the introduction to this month's column, the sentence following the word "somersault" contains a hidden secret. Clues can be found in the *last* sentence of the introduction, as well as in both sentences of this month's word trick.

L.F.S.

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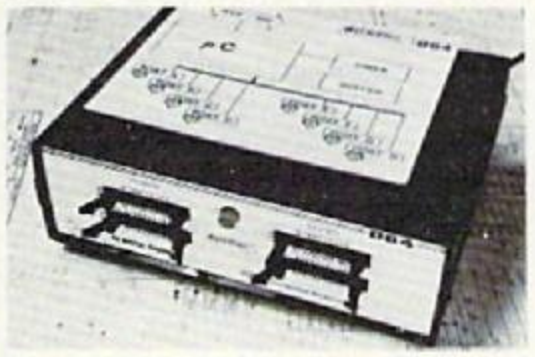

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(from page 29)

```
67Ø GOTO 28Ø
68Ø PRINT"{SHFT CLR}{3 CRSR DNs}"
69Ø GOSUB 77Ø
7ØØ PRINTTAB(8)PLAYER$(PLAYER);"WINS!!!{CRSR DN}"
71Ø PRINTTAB(8)"WITH ";PP(PLAYER);".{2 CRSR DNs}"
72Ø PRINTTAB(1Ø)"{CTRL 9}{CTRL 6}PLAY AGAIN?{CTRL 7}"
73Ø GET A$:IF A$="" GOTO 73Ø
74Ø IF A$="Y" THEN RUN
75Ø PRINT"{SHFT CLR}"
76Ø END
77Ø POKE VOLUME,15
78Ø POKE 54276,33
79Ø POKE VCE,4Ø
8ØØ FOR E=1 TO 1Ø:NEXT E
81Ø POKE VOLUME,15
82Ø POKE VCE,Ø
83Ø RETURN
```

Listing 2. Deadline program for the VIC-20.

```
1Ø REM ************
2Ø REM *{1Ø SPACEs}*
3Ø REM * DEADLINE *
4Ø REM *{1Ø SPACEs}*
5Ø REM ************
6Ø PRINT"{SHFT CLR}{2 CRSR DNs}"
7Ø PRINTTAB(6)"{CTRL 9}{CTRL 4}DEADLINE{CTRL 7}{2 CRSR
   DNs}"
8Ø PRINTTAB(1)"TWO PLAYERS WAIT"
9Ø PRINTTAB(1)"AS LONG AS THEY DARE"
1ØØ PRINTTAB(1)"BEFORE PRESSING KEY."
11Ø PRINTTAB(1)"CLOSER YOU GET TO"
12Ø PRINTTAB(1)"THE DEADLINE, THE"
13Ø PRINTTAB(1)"MORE POINTS YOU GET."
14Ø PRINT"{3 CRSR DNs}";TAB(6)"{CTRL 9}{CTRL 3}HIT ANY
   KEY"
15Ø PRINTTAB(4)"{CTRL 9}FOR FIRST ROUND{CTRL 7}"
16Ø GET A$:IF A$="" GOTO 16Ø
17Ø PLAYER=1
18Ø FOR N=1 TO 2
19Ø PRINT"{SHFT CLR}{2 CRSR DNs}"
2ØØ PRINTTAB(1)"ENTER NAME OF"
21Ø PRINTTAB(1)"PLAYER #";N
22Ø INPUT PLAYER$(N)
23Ø NEXT N
24Ø PRINT"{SHFT CLR}"
25Ø PRINTTAB(1)"IT IS NOW"
26Ø PRINTTAB(1)PLAYER$(PLAYER);"'S TURN."
27Ø PRINT"{3 CRSR DNs}";TAB(6)"{CTRL 9}{CTRL 3}HIT ANY
   KEY"
28Ø PRINTTAB(4)"{CTRL 9}FOR NEXT ROUND{CTRL 7}"
29Ø GET A$:IF A$="" GOTO 29Ø
3ØØ PT=INT(RND(1)*5ØØ)+1ØØ
31Ø POKE 36878,15
32Ø FOR N=1 TO PT
33Ø POKE 36876,255
34Ø POKE 36876,Ø
35Ø GET A$
36Ø IF A$<>"" GOTO 47Ø
37Ø PRINTTAB(8)N
38Ø NEXT N
39Ø GOSUB 74Ø
4ØØ PRINT"{SHFT CLR}{2 CRSR DNs}"
41Ø PRINTTAB(1)"SORRY, SPORT. TIME{CRSR DN}"
42Ø PRINTTAB(1)"HAS RUN OUT.YOU LOSE{CRSR DN}"
43Ø PRINTTAB(1)PT;" POINTS.{2 CRSR DNs}"
44Ø GA=-PT
45Ø GOTO 57Ø
46Ø GOTO 57Ø
47Ø GOSUB 74Ø
```

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Listing 2 continued.

```
48Ø PRINT"{SHFT CLR}"
49Ø IF INT(PT/2)>N THEN PRINTTAB(1)"SORRY, SPORT.{CRSR
    DN}"
5ØØ PRINTTAB(1)"YOU GOT UP TO{CRSR DN}"
51Ø PRINTTAB(1)N;" AND COULD{CRSR DN}"
52Ø PRINTTAB(1)"HAVE GONE AS FAR AS{CRSR DN}"
53Ø PRINTTAB(1)PT;". YOU GET SOME{CRSR DN}"
54Ø DF=PT-N
55Ø GA=N-DF
56Ø PRINTTAB(1)GA;"POINTS.{CRSR DN}"
57Ø PP(PLAYER)=PP(PLAYER)+GA
58Ø IF PP(PLAYER)>499 GOTO 66Ø
59Ø PRINTTAB(1)"YOUR SCORE:";PP(PLAYER)
6ØØ PRINT"{3 CRSR DNs}";TAB(6)"{CTRL 9}{CTRL 3}HIT ANY
    KEY"
61Ø PRINTTAB(4)"{CTRL 9}FÓR NEXT ROUND{CTRL 7}"
62Ø GET A$:IF A$="" GOTO 62Ø
63Ø IF PLAYER=1 THEN PLAYER=2:GOTO 24Ø
64Ø PLAYER=1
65Ø GOTO 24Ø
66Ø PRINT"{SHFT CLR}{3 CRSR DNs}"
67Ø GOSUB 81Ø
68Ø PRINTTAB(2)PLAYER$(PLAYER);" WINS!!!{CRSR DN}"
69Ø PRINTTAB(2)"WITH ";PP(PLAYER);".{2 CRSR DNs}"
7ØØ PRINTTAB(4)"{CTRL 9}{CTRL 6}PLAY AGAIN?{CTRL 7}"
71Ø GET A$:IF A$="" GOTO 71Ø
72Ø IF A$="Y" THEN RUN
73Ø PRINT"{SHFT CLR}"
74Ø POKE 36878,15
75Ø FOR L=13Ø TO 254
76Ø POKE 36876,L
77Ø NEXT L
78Ø POKE 36878,Ø
79Ø POKE 36876,Ø
8ØØ RETURN
81Ø POKE 36878,15
82Ø FOR L=1 TO 1Ø
83Ø FOR M=18Ø TO 235 STEP 2
84Ø POKE 36876,M
85Ø FOR N=1 TO 1Ø
86Ø NEXT N
87Ø POKE 36876,Ø
88Ø NEXT L
89Ø POKE 36878,Ø
9ØØ RETURN
```


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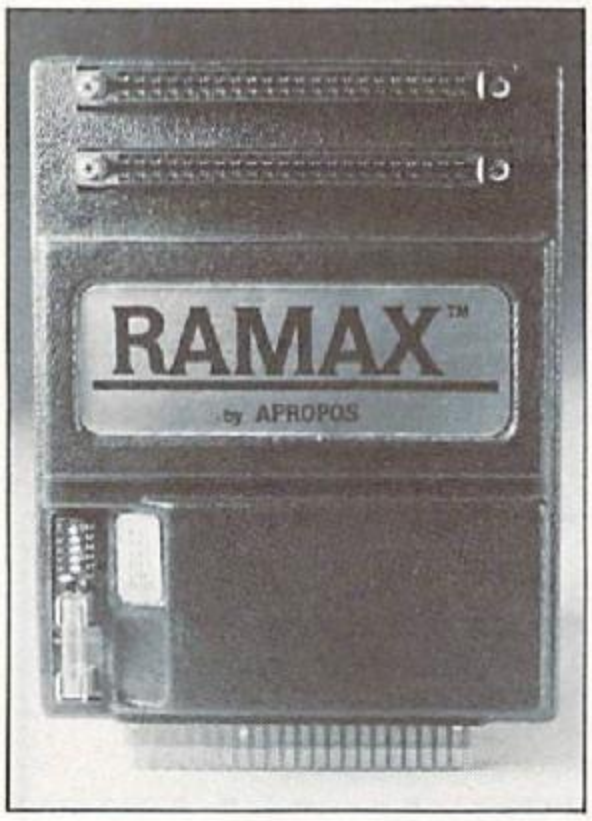

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Have you ever been in the process of writing a program and thought that just one more subroutine or a fancy title screen might be just the thing to make it complete, only to find that there is no more room in your VIC-20's memory? While looking through a magazine, have you ever discovered a particular program that would round out your software library, only to find that it requires at least an 8K or 16K expander? Or perhaps, after you've entered the last few pieces of data into a program, everything has come crashing to a halt with that dreaded Out Of Memory error.

If you're a VIC-20 owner, sooner or later you'll start thinking about buying a memory expansion cartridge of some kind, but it may not be an easy choice once you do decide to buy. There are a number of companies that manufacture expansion devices for the VIC; these devices come in all sizes, shapes, prices and memory configurations, from 3K, 8K to 16K. Some companies advertise expanders that offer 64K.

One piece of information that might help you to decide which one of these to buy is the fact that, due to the VIC-20's particular method of internal addressing, the maximum usable memory (that can be accessed at any one time) is 32K. With that in mind, the choices are much easier. If you want to buy the top-of-the-line in memory expansion devices, you should seriously consider the Ramax memory expansion board, from Apropos Technology.

The Ramax expander offers a full 27K of extra usable memory—added to the VIC's 5K, this brings the total up to 32K. The unit has two extension connectors that allow you to connect other VIC cartridges. It also has a built-in reset switch. It is fuse-protected, and it has a six-month parts and labor warranty.

Ramax is totally self-contained, using no external power supply. The gold-plated edge connectors offer more reliability, and the expander may be used with any VIC-20-compatible cartridge. Also, Ramax uses very little power.

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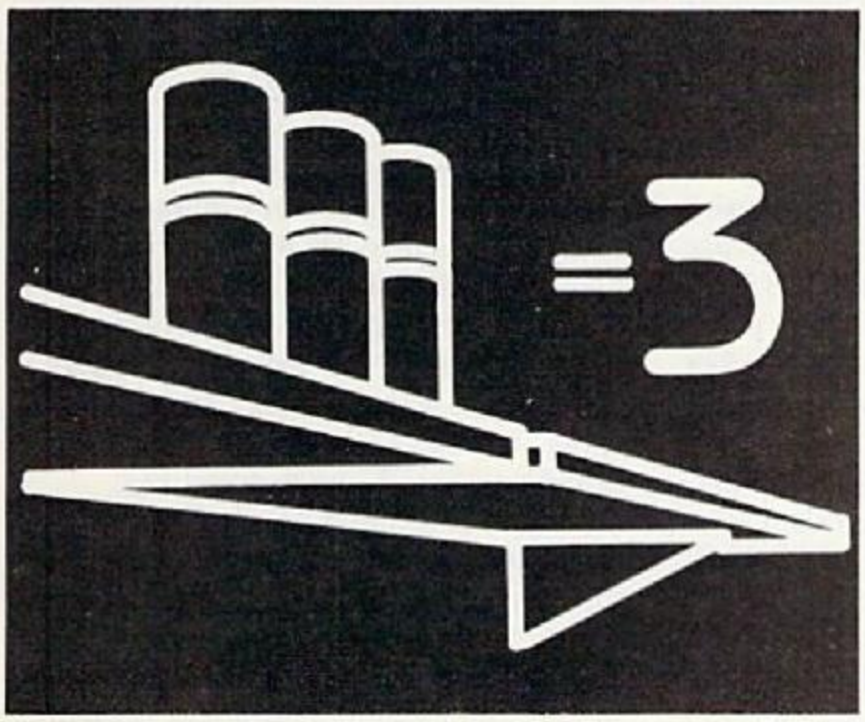

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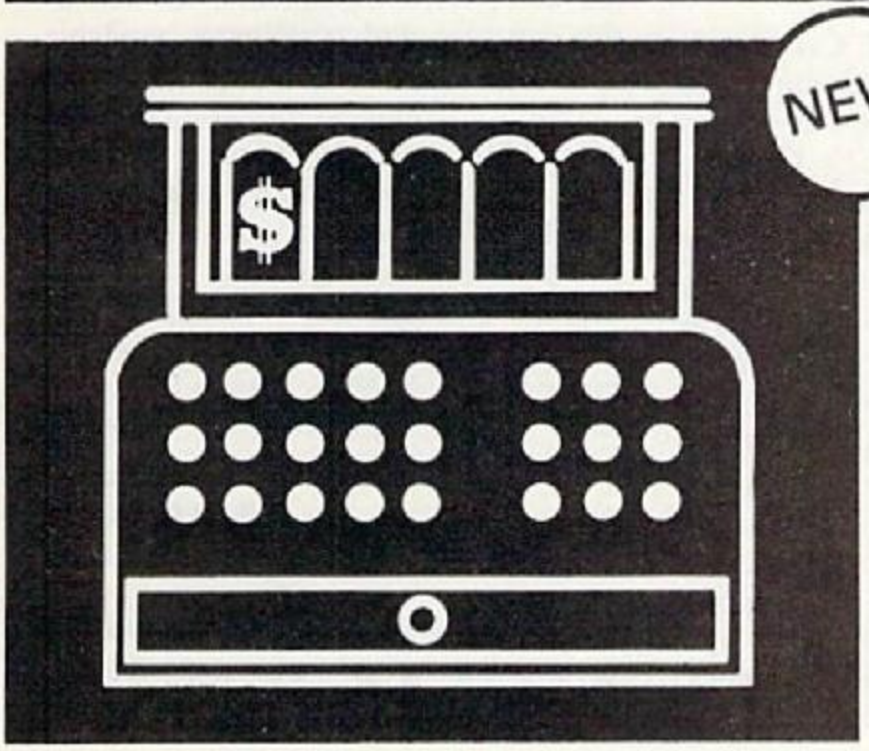

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to 24575) and switch #3 controls another 8K (addresses 24576 to 32767). Switch #4 controls block 5, where some cartridges reside (addresses 40960 to 49151). This switch does not contain extra memory—it only allows you to switch Ramax in or out of this area when you are using other cartridges. This means that you can leave game or hardware cartridges plugged in all the time and save wear and tear on your system—you simply throw this switch when you want to activate or deactivate the slot. Switch #6 is the reset switch, which is handy when you want to reset the system without turning everything off and then back on again.

You need not worry that Ramax is only for the hard-core computer nut. Anyone can utilize the device right away. The manual that comes with Ramax is simple and even gives you a short memory test program for the expander. If you never intend to switch banks of memory in or out, you can set the switches once and never touch them again. After you have decided on a configuration, you might even forget that you're using an expander.

The only shortcoming that I have found in the Ramax expander is the size and placement of the reset DIP switch. It is very small, and it tucks in very close to the back of the computer. When the unit is plugged in, it is difficult to turn the switch on and off—but this is a very minor flaw. (Perhaps later models will have a reset button instead of a switch.)

Everything considered, the Ramax memory expander is a well-constructed unit that lives up to its billing. *(Apropos Technology, 1071-A Avenida Acaso, Camarillo, CA 93010. $79.95.)*

Guy Wright
***RUN* staff**

Commodore 64 Training Tape

Learn About Your C-64 From Commodore Expert Jim Butterfield

Commodore computers are a common sight in my home. I have a VIC-20 and two C-64s hooked up in my study and an SX-64 in my bedroom. Floppy disks, cassettes, cartridges and photographs of new products are everywhere.

In a household like this, you would expect everyone to be a programming whiz, right? Wrong. The hardware and software are there, but according to my wife and son, a good teacher is still needed. They have had problems with my tutoring style; my lack of patience and my assumptions that they are technically well-versed are the main problems. They like our Commodores, but they don't care for me to indoctrinate or instruct them.

As if in answer to their prayers, a package arrived the other day that contained something very special. It was a videotape cassette of Jim Butterfield giving instruction on the Commodore 64.

The tape runs approximately two hours, and it's packed with useful information about the C-64.

Butterfield, a native of Canada, is possibly the best-known Commodore personality in the world. He's an associate editor of *COMPUTE!'s Gazette*, and he has taught at Commodore's summer computer camps. He's a genuinely likeable man who really knows his stuff, and he does an excellent job of telling it like it is in the 14 segments of the tape.

Butterfield covers everything from unpacking the C-64 and hooking it up, all the way up to computer games and simulations. He gives lucid explanations of what a C-64 is, how to get started, how to run programs and much more. He explores topics such as telecommunications, optional languages, graphics, music, games and other uses and features of the machine.

His relaxed style puts you at ease as he covers the gamut of information about the C-64. He rarely speaks in complex technical terms, and when he does, he always clarifies things in everyday English. The videotape format allows you to absorb the information at your own pace—it's easy to rewind the tape and replay a segment.

This tape is not a programming tutorial, so don't expect to be able to spew forth top-notch programs after viewing it. It is, however, an excellent orientation to the numerous features and applications of the Commodore 64. It gives you a light treatise about what's going on inside the computer while it's performing a task.

The aesthetic aspects of the cassette aren't what could be called the Hollywood standard, but the quality is good—the lighting, video and audio are all more than adequate, and the content is excellent.

One of the more endearing features of this tutorial is that, on a few occasions during the lessons, Butterfield proves that he, too, is only human. One such instance involves his trying to load a program from disk, only to find that he hasn't turned the drive on! Although these scenes could have been easily edited out and re-taped, the editors chose to leave them in, giving the tutorial a natural, unrehearsed feel.

I highly recommend this videotape to the new C-64 owner. It imparts a lot of the knowledge found in the user's manual in a clear, concise style. By viewing this tape, the new owner will get a much clearer and more dramatic idea of the computer's capabilities, as well as the software and peripherals available for it.

If you're contemplating the purchase of a C-64, consider buying the videotape at the same time—it makes an excellent first accessory that will give you pointers on what other items you may want to buy for your computer before you go out and shop. *(PF Communications, 2727 N. Grove Industrial Drive #101, Fresno, CA 93727. $39.95.)*

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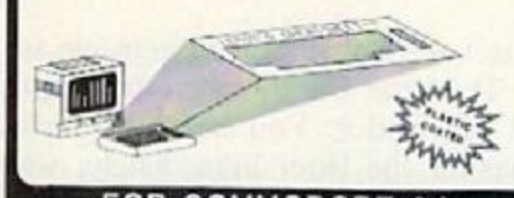

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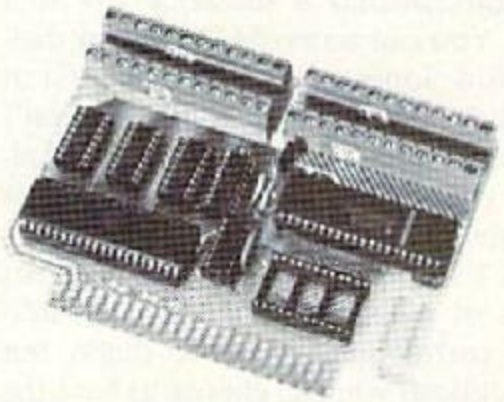

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The Mail RUN

For Multilinguists

I am a subscriber to *RUN*. We have a C-64, which I use to program, to store information with my database programs and to play games (I admit). My daughters (ages 7 and 10) use it for game-playing, learning Basic programming, Logo and Comal.

Why don't you have any Logo or Comal programs or articles? These languages are so much better for teaching children programming. Also, I am not familiar with the Pilot language, but why also don't you have any Pilot programs? I feel this is a serious deficit on your part, otherwise, we love your magazine.

Thomas Trocco
Dalton, MA

Watch for our October issue, which will feature introductory articles on programming languages, other than Basic, that you can use on your Commodore.

Editors

Improve the 64

I am very happy with my Commodore 64. Now Commodore Business Machines (CBM) is pretending to introduce two new home computers: the 264 and the 364, with enormous memory banks, built-in programs and many more goodies.

There is only one little problem: None of my 400 programs will run on those computers. (I am glad to read that CBM is reconsidering those computers.) Do you believe I will go out and peel $500 to buy one of those computers? If you do, you're out of your mind!

What I want to see is an improved Commodore 64, with the wedge as a permanent resident, so I can control and access my disk drive with ease. Maybe a better wedge.

I would like to see a built-in word processor, like Easy Script, that I can access with a flip of a switch, and a spreadsheet like Practicalc, powerful but easy to use.

There are many ways to improve the C-64. How about a numeric key pad at the right of the board? That would be a great help when we work with the spreadsheet.

How about a built-in modem with jacks for the telephone and the phone lines, and a program in residence so we can switch from word processing to modem in one second?

I believe CBM wasted a lot of time and money working on the new models instead of trying to improve and launch a better 64. If I saw an improved 64 on the market, I wouldn't hesitate to peel $500, or maybe more, and get me one hell of a personal computer.

Albert H. Coya
Miami, FL

That's Service!

A few months ago our school bought Cardco's Card?+g for our VIC-20 computers. This was my first experience with an interface, but this company has made it most painless, indeed!

When I had some questions, I called the number listed in their manual and talked to a very patient advisor. Then, two weeks ago one of the connectors broke, and our efforts to fix it ruined it completely. I called their company, which sent me two new connectors, free of charge, within a week!

We hear so much about poor documentation and service, I thought you might like to hear about a company that seems to go out of its way to make sure its customers are "up and running." I wish companies in other fields were so cooperative.

Sandra Smith
Sequim, WA

Protection Against Protection

I use my C-64 to help manage and promote my small organ and piano service business. I also have a little ten-month-old girl who tries to help daddy with the computer.

When you combine a little girl and a computer, the first thing that comes to mind is backup copies of important programs on disk. I have found that protected software seems to be a common practice with software producers. This is all right up to a point, but business programs and data need to be copyable. I will not buy a protected business program, only to wait three months for a $5 replacement because my daughter ate my inventory control.

I have tried one of the new copy programs, only to find that the disk it comes on is so protected that it's either impossible to copy or not worth the hours of effort.

If a software maker feels that his program is so darn valuable, he should put it on a cartridge. This way, we users will have instant loading and won't have to wait for ten minutes for the program to load while the protection scheme beats the heck out of our disk drives.

Tom Niderost
Talmage, CA

Reason to Go Ape

I have only one word—great! I thank you, and the Commodore people should thank you, too. Because of *RUN*, my interest in computers has been renewed, and I recently upgraded my VIC-20 to a C-64 with printer and disk drive.

I have used several programs from your magazine, but really went ape over "Database Deluxe" (February 1984). Thanks, Mr. Stilwell.

I'm looking forward to spending many more years with *RUN*. Keep up the good work!

Dale Lindeau
Axle, TX

Better Late Than Never

Even though *RUN* gets to me two or three months late here in Sydney, it still stands head-and-shoulders above the Australian magazines published here.

Congratulations particularly on the Magic column, as it is packed with useful hints and tricks.

Paul Samaras
Sydney, Australia

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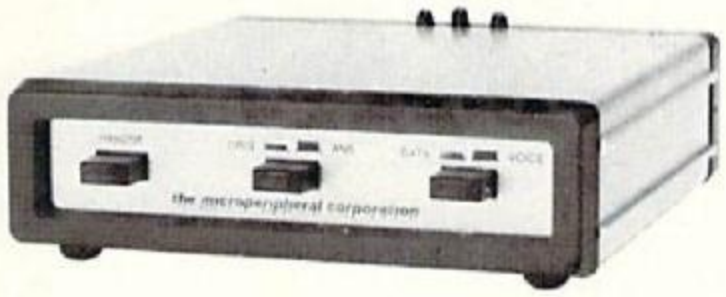

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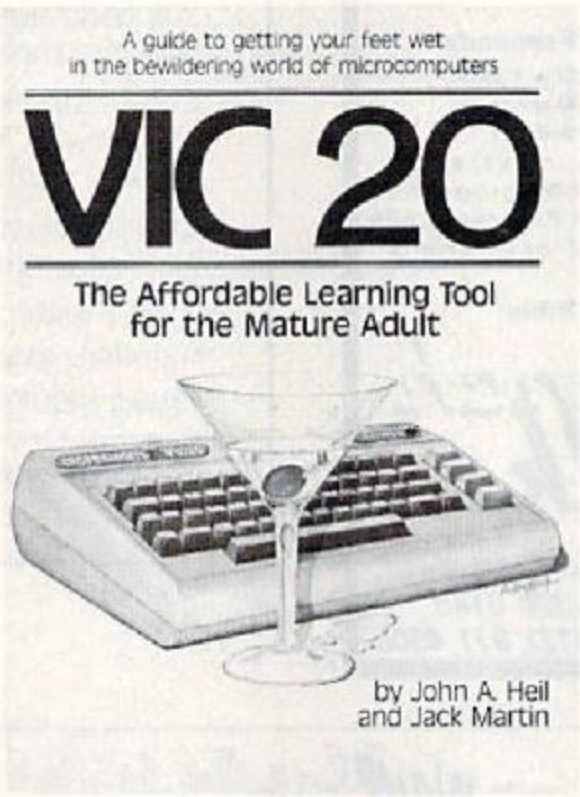
Book Gallery

Compiled by Shawn Laflamme

VIC-20: The Affordable Learning Tool For the Mature Adult

John A. Heil and Jack Martin
Banbury Books, Inc.
353 W. Lancaster Ave.
Wayne, PA 19087
Softcover, 201 pp., $14.95


A guide to getting your feet wet
in the bewildering world of microcomputers
VIC 20
The Affordable Learning Tool
for the Mature Adult
by John A. Heil
and Jack Martin

This past year has seen a veritable flood of programming books for the VIC-20, but unfortunately most of these use a juvenile approach. You know the type of book I'm thinking of—dragons, elves and pixies dance through its pages. While some very young children might be motivated by fantasy to learn about computers, the fact remains that a large percentage of VIC-20 users are adults and young adults. This audience doesn't need to be persuaded to learn about their computers—they already want to, and no amount of gremlins, dwarves, ogres or magic is needed to persuade them further. All they need is a book written in a clear, logical, coherent fashion, without the frivolity. If you're a part of this crowd, then *VIC-20: The Affordable Learning Tool for the Mature Adult* is for you.

Although the title is a bit ostentatious, the idea of the book is a good one. Authors Heil and Martin introduce the VIC-20 novice to the rudiments of Basic programming without being condescending. They assume that the reader is an intelligent, curious person who desires to learn more about computers in general and the VIC-20 in particular. I like this style. It doesn't try to entertain you with goofy cartoon creatures, and yet it gets to the point without being dry.

The first two chapters show you how to hook up the VIC-20 and start entering commands that make sense. All the things that are "too obvious" to mention are mentioned! Topics such as syntax for arithmetic statements and the idiosyncrasies of variables are treated in some detail.

By the time you have mastered these fundamentals, you're ready to move on to the first principles of programming, which are introduced in chapter three. The Data statement is mentioned early on, the idea being to get you used to the notion of the VIC-20 (or any computer) as an information handler.

Input, If/Then, GOTO and For/Next are treated in the next four chapters. A number of hints and tips are given along the way, such as error trapping, working with integers and keeping track of time.

Rather than dwelling on games and simple amusements, as so many computer books do, *The Affordable Learning Tool* shows you how to put your new knowledge to work in useful ways. In fact, these early chapters eventually lead to the construction of a simple database program, and you can't get much more practical than that!

Chapters eight and nine tackle the concepts of nested loops and subroutines. In this way, you are led to appreciate some of the basic principles of structured programming.

The next two chapters describe several other Basic commands, and the techniques of flowcharting are presented. Chapter twelve discusses the concept of sorting, explaining why it's important and how it's done with a VIC-20.

Chapter thirteen ties everything together with a complete address-book program that uses the concepts covered in the previous chapters.

Heil and Martin deliberately stick to commands that most other microcomputers have. It's not the particular computer you use that's important here, but rather how you go about talking to it. After completing this book, you should feel confident enough to take up a conversation with just about any computer that "speaks" Basic. Though a knowledge of a dozen commands can hardly be considered mastery, you would be surprised with what you can do with this small set of commands!

Old pros will find nothing new in this book, especially since it unveils only a dozen or so Basic commands and keeps strictly away from graphics, sound and animation. Beginners who wish to do something useful will derive the most benefit from it. This could be a very handy book to have around when a friend or relative asks, "But what's a VIC-20 good for?"

One thing that bothers me about this book is the authors' negative attitude toward mathematics. (Actually, they tend to confuse arithmetic with mathematics, which makes one a little suspicious.) Boolean algebra is described as "impenetrable by normal minds." This isn't true. Boole's own work on the subject is quite straightforward—a high

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school education is about all it takes. The authors shouldn't close doors for the reader.

Despite this, I still recommend the book. It makes clear the rudiments of programming and introduces an adult to the world of computers with one of the most affordable tools around.

Thomas Henry
Mankato, MN

Commodore 64 Programs For the Home

Charles D. Sternberg
Hayden Book Company, Inc.
10 Mulholland Drive
Hasbrouck Heights, NJ 07604
Softcover, 170 pp., $14.95

Charles Sternberg's *Commodore 64 Programs for the Home* contains a whole library of useful programs. There are no space-battle games or futuristic adventures here, but you *will* find programs for budgets, mortgage payments, meal planning, auto maintenance and trip planning, to name a few. The book contains a grand total of 40 home-aid programs.

Need help with the household budget? Would you like a meal-planning program or telephone directory program? How about some help with the kids' school work? If you answered yes to any of these, then Sternberg has included something for you.

Novices will appreciate Sternberg's care in explaining what each program will do and how it will do it. A test run is also included for each program.

The test run is a real blessing for inexperienced users. It's frustrating when you're not sure if your program is working correctly, after laboring over the listing. The test run removes the mystery and misery. If you input the same data in the example and receive the same results, you know your copy is correct.

Sternberg also includes a table after each listing, explaining what the program's major variables represent. This should help the beginner to visualize the flow of the program and aid in any modification, if desired.

Each program is introduced with a short description of what it will do, followed by instructions. Likely problems are noted and solutions to them are specified.

The last instructions given before the listings are modification procedures. Again, Sternberg is very kind to the novice. He points out where modifications can easily be made and suggests what they might be. Many people, after entering a listing, want to customize the program to meet their exact needs. This might involve dropping never-used loops or inserting others to make one program do the work of several. Sternberg foresaw this desire.

Most of the listings are very short, averaging 40 or 50 lines each. There are no fancy title screens, no sound effects and no sprites. The listings are cut to the bone, easy to follow, and therefore, easy to modify.

If it isn't needed to get the job done,

If you want some useful home application programs, this book may be just what you're looking for.

Sternberg leaves it out. The novice should appreciate this. Half the fun is changing the listing, adding printout options, sounds and other finishing touches.

Most of the programs are written in straight Basic. There are no graphics symbols included in the listings, which is another blessing for the novice. Anyone who has ever tried to decode illegible Commodore symbols from a dot-matrix printer will appreciate their absence. Most of the programs would translate to almost any other 40-column computer.

I had hoped the book would use the disk drive as a storage device instead of Data lines. In a few programs, the cassette is used with instructions for translation to disk, but these use only sequential files. If you want to learn about relative or random access files, you'll have to consult another text.

If you're just learning about programming the C-64 and want some useful home application programs, then this book may be just what you're looking for. The more advanced programmer may be interested in an earlier book by Sternberg, *Basic Computer Programs for the Home*, also published by Hayden.

Gary V. Fields
Asheville, NC

Music and Sound for the Commodore 64

Bill L. Behrendt
Micro Text Publications, Inc.
Prentice-Hall, Inc.
Englewood Cliffs, NJ 07632
Softcover, 180 pp., $14.95,
$29.95 with disk

Music and Sound for the Commodore 64 is a wonderful book, but it is definitely not for everyone.

If you just want to learn how to get a few notes out of your C-64, then you would be better served by another text. However, if you want to know about the physics of sound, the ins and outs of electronic music synthesis, obtain a firm grounding in music theory and squeeze every possible sound out of your C-64, then this book is for you.

Author Bill Behrendt begins with a brief tour of the Commodore 64, then jumps right into the physics of sound with discussions of things such as harmonic waveforms; a few pages later, you're introduced to the voltage-control oscillator. Music theory—from staff to scales and chords—is covered in concise detail.

If you don't really want to know all that, you can skim the material and get to the programs. Appendix A, which occupies nearly half the book, consists of programs and explanations. You can use the programs without learning all the science behind sound generation. The text guides you through the use of each program, similar to documentation for a software package.

Music and Sound comes in two versions: book alone, or book and disk. If you value your time (and your sanity), get the disk version! The listings are long and tedious, with indecipherable graphics symbols in the Print statements.

Anyone who bought the C-64 because of its SID chip and was later disappointed by the difficulty of accessing it will appreciate the thoroughness of this book. It may very well be more than enough to suit your needs.

Sharon Aker
Sussex, NJ

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(from p. 6)

will then put you back into the Basic Command mode, ending the color program.

This program violates most of the tenets of good programming that I have adopted and come to appreciate over the years. It was created simply as an answer to the challenge of being as short as possible.

Michael Broussard
Woodbridge, VA

The Text-Character-Code Award

```
1 FORS=ØTO15:PRINT"{SHFT CLR}{3 CRSR DNs}":POKE53281,S:
  FORL=ØTO15:READX:PRINTCHR$(X),"BKGD="S,
2 PRINT"TEXT="L:NEXT:FORB=ØTO15:POKE5328Ø,B:FORT=1TO999
  :NEXT:WAIT653,1,1:NEXT
3 RESTORE:NEXT:DATA144,5,28,159,156,3Ø,31,158,129,149,1
  5Ø,151,152,153,154,155
```

This program displays all 16 text colors simultaneously for comparison, and holding down one of the shift keys or pressing the shift-lock key will freeze the display. The timing loop for the border flash can be adjusted to suit the user.

Roy B. Graff
Sheridan, WY

The Why-Didn't-I-Think-of-This?/Brute Force Award

```
1 INPUT"BO";A:POKE5328Ø,A:INPUT"BA";B:POKE53281,B:INPUT
  "T";C:POKE646,C:GOTO1
```

Simply input numbers 0–15 from your color chart when prompted.

David Gaulden
Columbus, OH

Random-Solution Award

```
1Ø X=INT(RND(1)*255)+1:PRINT"{SHFT CLR}{CTRL 9}"X:POKE3
   6879,X:FORT=1TO45Ø:NEXT:RUN
```

This is the simplest way that I know of to display all of the screen and border colors on my VIC-20. Also, in the upper left-hand corner of the screen, the Poke value is given.

Bill Moffatt
Bartow, FL

Editor's Note: *All?*

Most-Persistent-Programming Award

```
1 A(1)=5328Ø:A(2)=53281:A(3)=646:FORN=ØTO15:POKEA(K),N:
  INPUTK:NEXT:GOTO1
```

I previously sent you two versions of this challenge. This is the one to use—I promise not to send any more versions.

Run the program. Type 1 for border, 2 for background or 3 for print, then press the return key repeatedly until the color is right. Then press the next number (to choose border, background or print) and continue. When all colors are right, type 11 and press the return key to exit the program. It will print BAD SUBSCRIPT ERROR in 1 and then stop.

Getting fewer than six lines was not too hard. Anyone out there ready to try for half a line?

Don Wilkins
Burke, VA

The-Only-Person-to-Use-DEFFN Award

```
1Ø DEFFNC(X)=PEEK(X)+1+16*((PEEK(X)AND15)=15):PRINT"{SH
   FT CLR}1=BORDER 2=BACKGND 3=TEXT
2Ø GETA$:IFA$<CHR$(49)ORA$>CHR$(51)THEN2Ø
3Ø A=ASC(A$)-48:IFA<3THENX=53279+A:POKEX,FNC(X):GOTO2Ø
4Ø POKE646,FNC(646):GOTO1Ø
```

A simple way of exiting this routine can be accomplished by adding another line to detect a Return.

Chris Hebert
Sunnyvale, CA

The Hi-Res Award

```
1 C=553Ø4:R=56333:POKE56576,148:POKE53265,59:POKE53272,
  61:POKER,127:POKE1,51
2 A=52224:B=57344:FORI=ØTO15:X=A+4Ø*I:Y=B+32Ø*I:FORJ=ØT
  O15:POKEX+J,16*J+I:NEXT
3 K=Ø:FORJ=ØTO127:POKEY+J,PEEK(C+K):K=K+1:NEXT:NEXT:POK
  E1,55:POKER,129
```

This is a three-line Basic program that uses the C-64's hi-res bitmapped Graphics mode to display the 256 color combinations in a 16 × 16 matrix.

Barry G. Adams
Fredericton, New Brunswick
Canada

Father-and-Son Award

```
1Ø T=ABS(S=15):S=S*ABS(S<>15)-(S<>15):S=S*ABS(S<16):B=B
   +T:B=B*ABS(B<16)
2Ø POKE53281,S:POKE5328Ø,B:PRINT"{SHFT CLR}":FORT=ØTO15
   :POKE646,T:PRINT"{4 SPACEs}BORDER:";B;
3Ø PRINT"{2 SPACEs}SCREEN:";S"{2 SPACEs}TEXT:";T:NEXTT:
   FORD=1TO1ØØØ:NEXTD:GOTO1Ø
```

All the combinations of color for the border, background and text are displayed, along with the color codes used to produce each color, to help you duplicate these results in original programs. I rejected the temptation to submit an even shorter version of this routine, as its usefulness (the only justification for such a program) would be minimal.

Jerry E. Shepherd
West Valley City, UT

```
1Ø ?"{SHFT CLR}":FORB=ØTO15:FORS=ØTO15:?"{HOME}":FORT=Ø
   TO15:P{SHFT O}53281,S:P{SHFT O}5328Ø,B:P{SHFT O}646,
   T
2Ø PRINT"BORDER";B;"SCREEN";S;"{CRSR LF} TEXT";T;"{CRSR
    LF} ":NEXT:FORP=ØTO12ØØ:NEXT:NEXT:NEXT
```

My father submitted a three- and four-line routine to answer your challenge. After sending *his* in, he challenged *me* to come up with something using fewer lines than his. I created this two-line routine, and since it uses fewer lines, accomplishes the same purpose and uses logic that is easier to understand, my father suggested I send it in.

Jerry E. Shepherd, Jr.
West Valley City, UT

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RUN Amok

Item: In June's Commodore Clinic, there was an error in the answer to John Bryer's question (p. 12, col. 2). The second line of the listing near the top of the page should read PRINT#15..., not PRINT#5.

Item: Many readers have had trouble typing 64 Joystick Artist (June 1984, p. 90) into their C-64s, which is not too surprising, considering how many data statements there are. We have checked and rechecked the listing and can assure you that there are no errors. However, since so many people have called and written us about the program, we went through it and devised a way to help you detect typing errors.

It is a bit involved, but should help those of you who have had a problem. If followed carefully, the following steps should help locate errors in the data statements.

1. In each line that contains a READD:POKET,D:NEXT, change the end of the line so that it reads

READD:B=B+D:NEXT:PRINTB

For example, in line 100 change the end of the line so that it reads:

100 FORT=49152TO49456:READD:B=B+D:NEXT:PRINTB

The lines that need to be changed are: 100, 310, 410, 470, 730, 820, 880, 970 and 1060.

2. In each line that contains a READA:POKET,A:NEXT, you must also change the end of the line so that it reads:

READA:B=B+A:NEXT:PRINTB

For example, in line 1160 change the end of the line so that it reads:

1160 FORT=52224TO52283:READA:B=B+A:NEXT:PRINTB

The lines that need to be changed are: 1160, 1220, 1250, 1350, 1400, 1450 and 1480.

3. Insert a line:

1495 END

4. Type RUN 100. You should get a printed list of 16 numbers on the screen (a checksum) corresponding to each section of the data. The list *should* read: 31629, 47432, 55564, 102727, 117533, 124841, 138935, 154222, 167024, 169983, 173537, 191775, 197100, 202425, 204396, 206122.

If you didn't get these numbers, then you've made a mistake somewhere in typing your data statements. Where your list deviates from this list is the area of your program that you should check. If, for example, the first four numbers match but the rest are off, then go to the fifth instance of READD:B=B+D:NEXT:PRINTB that you changed (line 730) and check the data statements that follow (lines 740–810). If everything was fine up until the tenth number, but those from the eleventh onward were wrong, go to the eleventh "READ :B=B+" line that you changed (line 1220) and check the data statements after it (lines 1230–1240).

Be especially careful about numbers that are broken at the end of a line (if there's no comma, the number carries to the next line). Also watch for periods in place of commas and the very first number after the word DATA (sometimes that number can be easily overlooked). Another trick is to try to get a friend to read the listing out loud while you check each number.

5. When you get all the numbers to match ours, change the lines back to the way they first appeared and delete line 1495. The program should then work the way it was intended. Good luck and happy hunting.

Item: If you dialed Robert Shannon's bulletin board number as listed in the July Commodore Clinic column, then you dialed the wrong number. The correct number is 707-964-7114.

Item: The price of the Doodle! program was incorrectly listed in the July Software Gallery column. The correct cost of the program is $39.95.

How to type listings from *RUN*

Typing in listings can be difficult enough without having to worry about strange graphics characters, charts or tables. That's why we decided to make it easy to enter listings from *RUN* by translating everything we thought might be confusing in any program.

When you see something between the curly brackets, all you have to do is press the keys indicated. For example:

{SHIFT L}—means hold down the shift key and press the L key at the same time.
{COMD J}—means hold down the Commodore key (it is on the lower left side of the keyboard) and press the J key at the same time.
{SHIFT CLR}—hold down the shift key and press the CLR/HOME key.
{HOME}—press the CLR/HOME key without shifting.
{CTRL 6}—hold down the control key and press the 6 key.
{FUNCT 2}—function 2 (in this case, you hold down the shift key and press the function 1 key).
{CRSR UP} {CRSR DN} {CRSR LF} {CRSR RT}—these are the four cursor directions.
{UP ARROW}—means the arrow key (the one with the pi sign under it).
{LB.}—the British pound sign (£).
{PI}—the pi sign key (π); (shift and press the up arrow key).

In some instances, when a large number of characters or spaces are repeated in a listing, we will represent them this way: {22 spaces} or {17 CRSR LFs}.

Print vs Print#

RUN readers should be aware of difficulties that may arise when entering listings that contain the PRINT and PRINT# commands.

These two commands may look very similar, but they are different. If, for example, you use a question mark (?) to abbreviate PRINT in a line such as 10 PRINT#4,A$, then you are signaling to the Commodore computer that you are trying to print the variable #4, which is not a legal variable name.

The command PRINT#4 actually means "print to device number 4." You can abbreviate PRINT# by hitting the P key and the shift and R keys at the same time and then entering the device number. But *do not* abbreviate PRINT# with a question mark.

If you think of PRINT as one command and PRINT# as an entirely different command, then you should have no problems.

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Clubs

Commodore Convention

MARCA (Mid-Atlantic Regional Commodore Association) is a confederation of user groups in Pennsylvania, Maryland, Virginia and New Jersey, currently representing more than 3000 Commodore users. The group's main purpose is to facilitate information-sharing among Commodore users in the region.

MARCA is sponsoring a Commodore Convention on Saturday and Sunday, July 28 and 29, in Hershey, PA. There will be two days of speakers (including Jim Butterfield, the Strasmas and Len Lindsay) and workshops. Some of the best and newest in Commodore hardware, software, peripherals and so on, will be on display.

For more information, call Mindy Skelton, 717-486-3274 or write MARCA, PO Box 76, Mt. Holly Springs, PA 17065.

Nebraska

All Commodore owners who live in the Nebraska panhandle area are invited to attend meetings of the Alliance Commodore Computer Club. The 25-member group, which is new and very informal, meets on the third Wednesday of each month for a short tutorial on both the VIC-20 and C-64, followed by an open forum for questions.

For more information, contact Marilyn Sallee, 1629 Boise, Alliance, NE 69301.

Brandon, FL

The Brandon User's Group promotes and educates the general public in the use of the VIC-20 and C-64. The group holds meetings on the second and fourth Fridays of the month, from 7–10 PM, at the Brandon Civic Center, Sadie St., Brandon, FL. Meetings offer guest speakers, as well as members teaching Basic, intermediate and advanced programming, machine language, computer math and science and telecommunications.

Knoxville, TN

Meeting on the second Thursday of each month is the Metro-Knoxville Commodore User Club (MKCUC), from 6:30–9:00 PM, at the Deane Hill Recreation Center in Knoxville. The group will also be holding jam sessions on various Saturdays, so that members can copy the extensive library of public domain software (more than 4.2 megabytes of software).

For more information, contact Ed Pritchard (Club President), 7405 Oxmoor Rd., Knoxville, TN 37931, 615-938-3773.

Portland, ME

So. ME 64, a Commodore user's group in the southern Maine area, meets on the second Saturday and the last Wednesday of the month. The group offers its members a newsletter, a library and computer education.

For information, contact So. ME 64, c/o Edward Moore, 10 Walker St., Portland, ME 04102, 207-761-1626.

Wilmington, NC

There are two sections of the Wilmington Commodore User's Group (WCUG). The first meets on the second Tuesday of the month, the other on the third Wednesday of the month.

The group, which has associate memberships available, offers members a large public domain library, and is interested in exchanging information and public domain software with other user's groups.

For more information, contact Terry Brown (Club President), 409 R.L. Honeycutt Drive, Wilmington, NC 28403, 919-799-5041.

Coming Next Month

Just in Time for School—*RUN* will focus on education in the September issue. The lead article, written by a noted figure in the education field, will review over 50 commercially available educational packages for children from pre-school age (about 4–6 years) through the last year of elementary school (around 13 years). The article will examine the impact that software can have on a child's growth and success in school.

In Keeping with the Theme—*RUN* will also publish original programs that readers can type into their Commodore systems to teach their youngsters math and spelling.

Non-Academically Speaking—The September issue will feature reviews of eight major terminal communications packages (the software used with the Commodore computer, modem and telephone to communicate with fellow computerists across town or across the country). Noted Commodore author, Jim Strasma, explains what terminal communications software is, how it works, how to use it and what to look for when purchasing it for your system.

The Cop and the Computer—Here's an intriguing human-interest story and an unusual application of the Commodore 64: Randy Mooseles, 29, is a police detective for the city of Melbourne, FL. Tired of playing games with his computer, he came up with a more practical and arresting application for his C-64. Evil-doers, beware! Randy and his C-64 may be hot on your trail.

Mystery Revealed—The WEDGE has been called one of the C-64's most potentially useful programs. But because of sketchy documentation, many computerists are unable to make full use of all its functions. This article lifts the shroud of mystery surrounding this all-important program.

Also—The September issue will feature utilities, applications, reviews and regular columns to help the reader get the most out of his Commodore computer system. Regular features will include the popular MAGIC (hints and tips for Commodore owners) and Commodore Clinic (answers to readers' questions) columns, as well as Software Gallery (reviews of commercially available Commodore programs) and New Products RUNdown (announcements of the latest software and hardware products available for your Commodore system).

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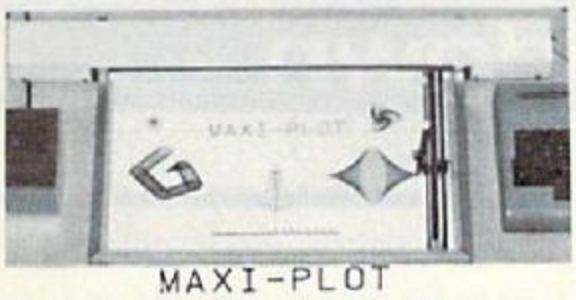

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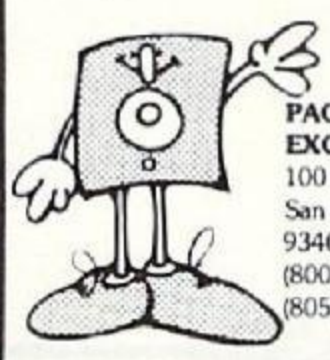

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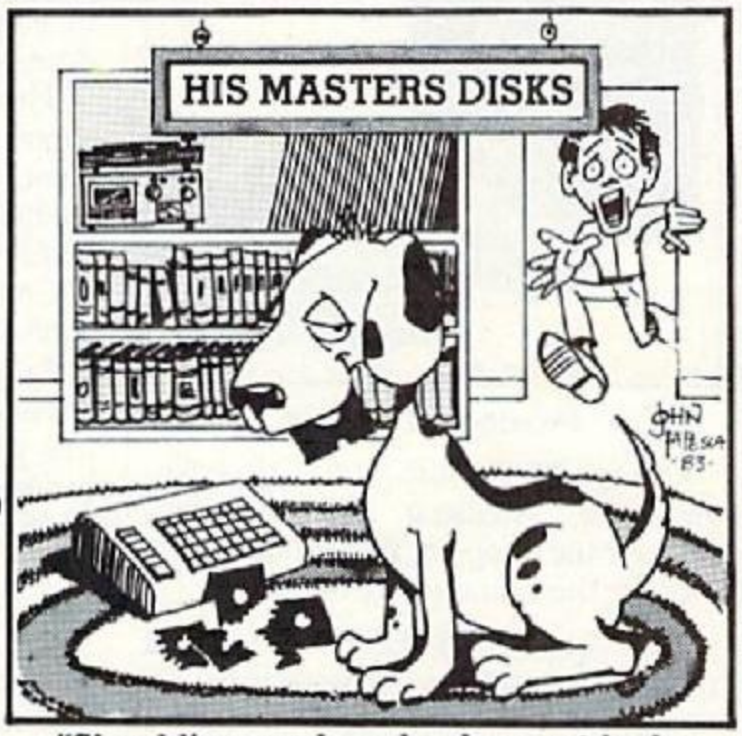

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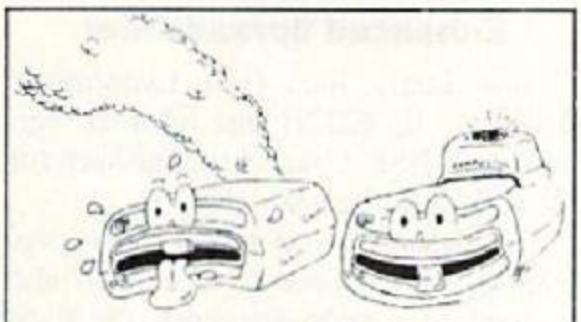

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New Products RUNdown

Compiled by Shawn Laflamme

Printer Interface

Orange Micro, Inc. (1400 N. Lakeview Ave., Anaheim, CA 92807) has released the Grappler CD Printer Interface for the Commodore 64.

The Grappler CD has four operating modes. In addition to standard code conversion, the Grappler CD contains a Commodore 1525 Emulation mode that enables your printer to create characters as they would appear on the C-1525. Graphics and special characters can be printed by Epson, Star, Okidata, Prowriter, NEC and other dot-matrix printers.

Screen dump routines allow the printing of hi-res and block graphics with a variety of options. Special screen dumps for Epson FX/RX aspect ratios are also included. Text formatting features include margin and page length setting.

The Grappler CD includes all required cables. Power is drawn from the expansion port to eliminate extra wiring. It has its own serial and expansion ports to accommodate other Commodore peripherals. Retail price of the Grappler CD is $139.

Check Reader Service number 428.

Sprite Utility

SpryteByter is a sprite creation and manipulation program for the Commodore 64.

The program lets you create up to 128 sprites in a single file, in either monocolor or multicolor. Menus provide over 60 commands, such as shift, rotate and invert/obvert.

Continuous display of your working sprite is provided in all four modes: normal, expanded-x, expanded-y and expanded-xy. The Game Maker feature lets you insert sprites into your Basic programs. You can control sprite definition from the keyboard or with a joystick.

SpryteByter is available on disk for $34.95. Microtechnic Solutions, Inc., PO Box 2940, New Haven, CT 06515.

Check Reader Service number 430.

Enhanced Spreadsheet

New Leaf, Inc. (120 Lynnhaven, Belleville, IL 62223) has released Version 2 of ESP Calc, a spreadsheet for the C-64 and the 24K VIC-20.

The new disk contains two programs—a high-speed C-64 version and a standard version for both the C-64 and the 24K VIC-20.

With the high-speed C-64 version, loading of models is up to four times faster than the original version, and calculating a spreadsheet is up to eight times faster. There is also 16% more data cell and calculation space.

ESP Calc Version 2 is available for $47.50. Owners of Version 1 can purchase the new disk for $10.

Check Reader Service number 403.

Data Cassette Recorder From Cardco

Cardco, Inc. (300 S. Topeka, Wichita, KS 67202) has released the Cardcorder DC/1, a data cassette player/recorder for the C-64 and the VIC-20.

The Cardcorder is capable of handling up to 120 minutes of tape (60 min. per side), including prerecorded commercial tapes and personal data tapes. It has the features of a standard cassette player, with record, play, rewind, fast forward, stop/eject and pause functions.

Retail price of the Cardcorder DC/1 is $59.95.

Check Reader Service number 425.

Challenge the Luftwaffe!

Infinity Software (536 Curie Drive, San Jose, CA 95123) has released Bandits at 4 O'Clock, a World War II battle game for the Commodore 64.

As the tail gunner of a B-36 bomber, you must defend your plane from fast, deadly enemy fighters. Skill and reflexes are needed to prevent destruction of your aircraft by your enemies.

Bandits at 4 O'Clock is available on disk and cassette for $29.

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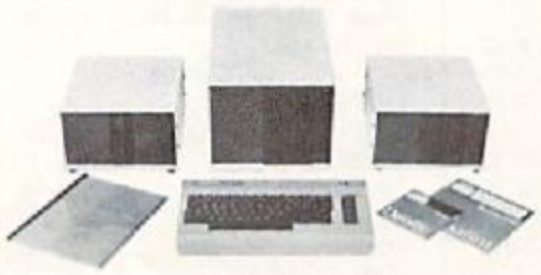

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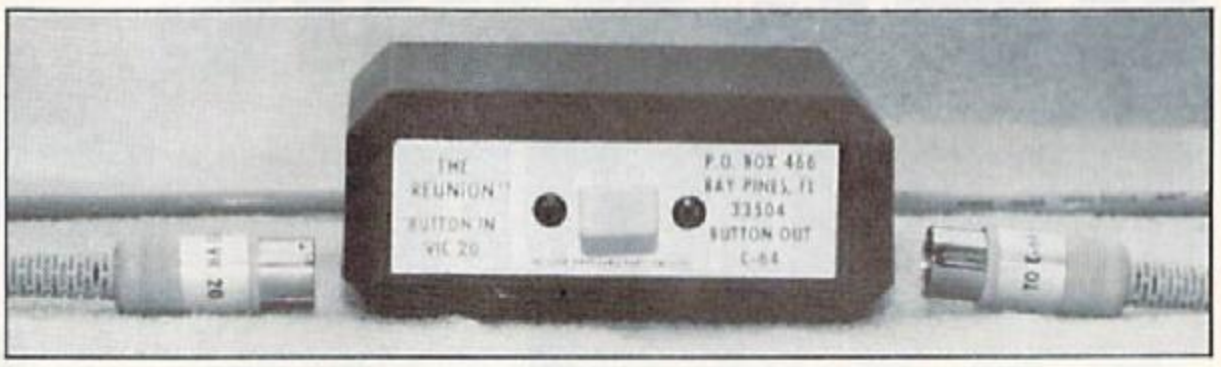

Bring Your Commodore Family Together

The Reunion, from HyTech (PO Box 466, Bay Pines, FL 33504), connects your disk drive and/or printer to both the VIC-20 and the C-64, providing instant use of either system.

The unit allows you to save and load VIC and C-64 programs on the same disk, thereby eliminating the need for disk swapping. Anything attached to either computer, such as a modem or expansion board, is not affected by The Reunion.

The Reunion is available in two models: Model A interfaces the VIC and C-64 to the disk drive and/or printer; Model B interfaces the VIC and C-64 to the Datassette recorder. The price of each model is $29.95.

Check Reader Service number 426.

Computer-Aided Design For the C-64

Kiwisoft Programs (18003-L Skypark South, Irvine, CA 92714) has released Cadpic, a picture-design package combining two programs for painting and printing.

Paintpic is a painting program that allows you to paint with 16 different colors on a 160 × 200 dot screen. Block operations include save, copy, double, halve, 90° rotate and mirror. Drawing and painting are done with the keyboard or a joystick.

Printapic provides a true-proportion, five gray-scale, dot-graphic printout of Paintpic pictures on most printers. Character printers are also supported.

No special hardware is required, although an MPS-801 graphics printer and Micron Technology's Microneye camera are recommended.

Cadpic is available on disk for the Commodore 64. It retails for $79.95. Paintpic and Printapic can be purchased separately for $39.95 and $44.95, respectively.

Check Reader Service number 400.

New Word Processor From HES

Human Engineered Software (150 North Hill Drive, Brisbane, CA 94005) has released OmniWriter & OmniSpell, a two-program package for the Commodore 64.

OmniWriter is a word processing program with features including: indentation and centering; headings and footings; mail merge for names, addresses and labels; underlining and boldfacing; scrolling capabilities and global search and replace.

OmniWriter is fully integrated with OmniSpell, a spelling checker with a 30,000-word dictionary. You can expand the dictionary to include the terminology used in your profession.

Through a conversion command, files from Microsoft's Multiplan (also published by Human Engineered Software) can be transferred to OmniWriter for inclusion in reports and documents.

The OmniWriter & OmniSpell package includes the program disk, a quick reference card, a keyboard overlay and a reference manual. It retails for $69.95.

Check Reader Service number 406.

Whodunit?

Epyx, Inc. (1043 Kiel Court, Sunnyvale, CA 94089) has released Robots of Dawn, a futuristic murder mystery based upon Isaac Asimov's recent best-selling novel.

The game puts you in the role of Elijah Baley, Earth's most famous detective. You must question the inhabitants of far-flung cultures and piece together elusive clues to determine who's lying, who's telling the truth and who is trying to murder you.

Robots of Dawn is available on disk for the Commodore 64.

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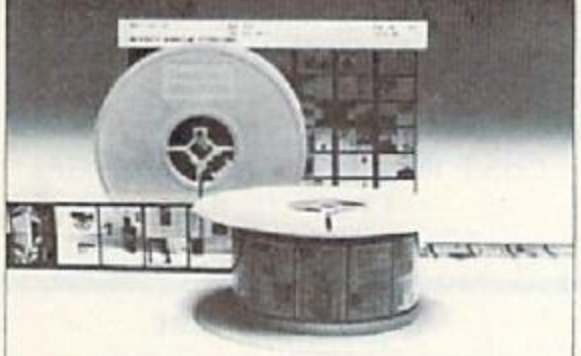

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Diskovery Reading Works

Gladstone Electronics, Inc. (1585 Kenmore Ave., Buffalo, NY 14217) has released the Diskovery Reading Works, a series of four C-64 software packages designed to help children increase their reading ability and thus improve their schoolwork.

The programs use an arcade game format with animated graphics, color and sound. Two of the programs, The Alphabet Factory and Match-Up, are designed for children aged three to eight. The other two, The Word Bird and Time Zone, are for ages six to twelve.

The four packages are available on disk for $29.95 each.

Check Reader Service number 402.

Meet Your C-64

I Am the C-64 is a tutorial that gives the new computer user a step-by-step introduction to the capabilities and functions of the Commodore 64.

The tutorial is available in two parts. The Introductory Series overviews the C-64 by presenting demonstrations and introducing programming terminology. The Advanced Series teaches Basic programming, including the commands that produce graphics and sound.

Each series is available on disk for $34.95. Creative Software, 230 East Caribbean Drive, Sunnyvale, CA 94086.

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New Products RUNdown

Color Graphics Package

Flying Colors is a new color graphics package designed for use with a standard joystick.

A screen menu lets you choose functions for drawing. Choices include thick and thin lines, automatic circles and boxes of any size, erasures and filling enclosed areas with color.

You can adjust your drawing speed for detailed work and paint with a variety of different colors and brush sizes. Text can be added anywhere on the screen. You can then save your pictures on disk.

Flying Colors also includes a Slide Projector program, allowing you to create your own slide shows.

Flying Colors is available on disk for the C-64. It retails for $39.95. The Computer Colorworks, 3030 Bridgeway, Sausalito, CA 94965.

Check Reader Service number 411.

One with the Universe

Zenji is a mystical game of intuition with an Eastern theme. Your task is to connect a glowing maze of elements (the Many) to the pulsating source (the One) to create Zenji, a single, unified green image.

The strategic and intellectual demands of the maze grow increasingly difficult as you proceed, and you must avoid deadly Flames of Desire and the illusions that they emit.

Zenji is available for the Commodore 64. It retails for $34.95 on disk and $39.95 on cartridge. Activision, Inc., 2350 Bayshore Frontage Road, Mountain View, CA 94043.

Check Reader Service number 418.

Eliminate Interference

Bytes & Pieces, Inc. (550 N. 68th St., Wauwatosa, WI 53213) has released an interference filter kit for the Commodore 64.

Many of the older Commodore 64s have rf interference problems due to rf emissions from the computer unit. The interference filter kit is designed to eliminate these interference problems.

The kit requires opening the computer and making three solder connections. Detailed instructions for installation are included. Retail price of the kit is $15.95.

Check Reader Service number 423.

Play the Horses

Horses OTB is a thoroughbred horse race handicapping program that can be used for offtrack betting (OTB).

The program asks questions about each horse in the race, which you must answer with information from your Daily Racing Form. The program then suggests horses to bet on.

No judgement or comparison of odds is necessary, and you do not need to know the track odds.

Horses OTB is available on disk for the C-64. It retails for $34.95. 3G Company, Inc., Rt. 3, PO Box 28a, Gaston, OR 97119.

Check Reader Service number 412.

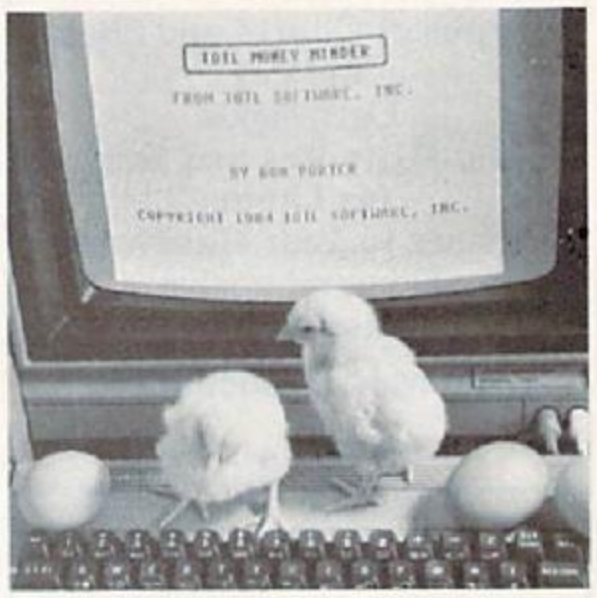
Futuristic Freedom Fighter

In Skramble, it is the year 2184. After years of constant bombardment, Earth has been conquered by Cobrons, who have now departed. They have left the government of Earth in the hands of a super-intelligent command module.

Your mission is to destroy the command module base, but the defenders of the base are formidable. A steady hand and accurate control are needed to guide your fighter plane on this suicidal mission.

Skramble is available on disk and cassette for the Commodore 64. It retails for $19.95. Advantage Computer Accessories, 1020 Meyerside Drive, Unit 8, Mississauga, Ontario L5T 1K7, Canada.

Check Reader Service number 417.



Money Management Software

Totl Software, Inc. (1555 Third Ave., Walnut Creek, CA 94596) has added Totl.Moneyminder to its line of small business and home productivity software for the Commodore 64.

Totl.Moneyminder is a home accounting system that allows you to define up to 110 accounts for expenses, checking, income, charge accounts and more. The program has monthly budgeting capabilities, and it provides a monthly reminder of all bills due.

The system will record up to 8400 transactions per year. It can report net worth and print or display actual versus budgeted expenses, with reports on the status of each account.

A report is generated at the year's end, showing all income and expenses. The program is compatible with Totl's word processing, mailing list and database management software.

Totl.Moneyminder is available on disk for $39.95.

Check Reader Service number 413.

C-64 Expander

Apropos Technology (1071-A Avenida Acaso, Camarillo, CA 93010) has released Aprospand-64, a 4-connector expander for the Commodore 64.

Aprospand-64 allows you to plug in up to four cartridges and access any one, or a combination of them, by switching. It has a system reset button and a fuse to protect the C-64.

The unit is enclosed in a plastic housing. A one-year warranty and an instruction booklet are included. Retail price is $39.95.

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Playful Professor

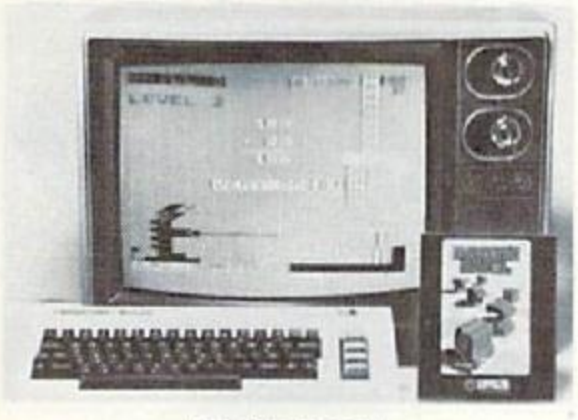
Screenplay (PO Box 3558, Chapel Hill, NC 27514) has released Playful Professor, a math tutorial program for ages five through twelve.

The program teaches addition, subtraction, multiplication and division in a game format. The game features a magic castle with a rollicking ghost who dances from room to room while holding a golden key. Each player is presented with a math problem. After a correct answer is given, the player has the opportunity to move closer to the key. The player who successfully escapes from the castle by unlocking the door is the winner.

When an incorrect answer is given, the professor provides an explanation of the problem on his chalkboard. The program includes several skill levels; as the child's abilities improve, the professor advances to more difficult exercises.

Playful Professor is available on disk or cassette for the Commodore 64. It retails for $29.95.

Check Reader Service number 409.



Math Duel

PractiCorp (44 Oak St., The Silk Mill, Newton Upper Falls, MA 02164) has released Math Duel, a new educational program for the VIC-20.

Math Duel is designed for students in grades one through six. The program teaches the fundamentals of addition, subtraction, multiplication and division by pitting the student against a dragon in a den. The three difficulty levels accommodate students of various ages and skills.

Math Duel is available on cassette for $19.95.

Check Reader Service number 405.

Build a Fortress

Strategic Simulations, Inc. (883 Stierlin Road, Bldg. A-200, Mountain View, CA 94043) has released Fortress, a game of strategy, power and conquest.

Your object is to occupy a location, fortify it and dominate the surrounding countryside. You can lay seige to your opponent's fortresses, or better still, outflank him.

There are options for one or two players. The solitaire game provides five different computer opponents, all with names to match their particular style of play: Genghis Khan, Count Vauban, Lord Maginot, Sir Galahad and the Squire. Each time they face you, your computer opponents improve by studying your strengths and weaknesses.

Fortress is available on disk for the Commodore 64. It retails for $34.95.

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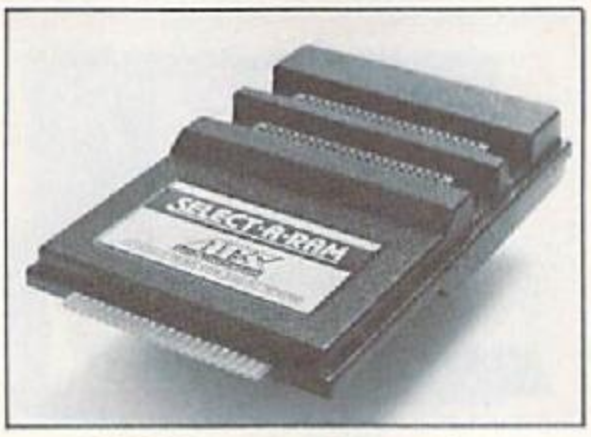

VIC Memory Expander

Advanced Processor Systems (PO Box 43006, Austin, TX 78745) has released Select-a-RAM, a memory expansion cartridge for the VIC-20.

Select-a-RAM adds 64K of random access memory (RAM) to the VIC-20. More memory can be added as the need arises. The cartridge has two expansion slots that will accept any amount of memory from 3K to 128K.

Select-a-RAM's features also include a system reset switch, memory write protection, provisions for optional external power and advanced programmable control. It is compatible with all VIC-20 hardware and software. Retail price is $169.

Check Reader Service number 427.

Save the Kingdom

Interphase Technologies, Inc. (6391-F Westminster Hwy., Richmond, BC V7C 4V4 Canada) has released Viking Raider, an adventure game with animated graphics and interactive text.

In the beginning, the Kingdom of Navay was usurped by Smoth, an evil ogre. Leif, a true patriotic Viking, must attempt to slay Smoth and save the kingdom.

Leif must first acquire sufficient wealth in order to fight. As he travels through the countryside in search of lost treasure, he encounters obstacles such as the militia, trolls and a fire-breathing dragon. Once he has amassed enough wealth, Leif must find the Golden Key to enter the castle for a confrontation with Smoth.

Viking Raider is available in a cartridge/disk combination for the Commodore 64. It retails for $44.95.

Check Reader Service number 421.

Home Management System

Ultraplan is a home management system for the Commodore 64, combining the features of a spreadsheet with a graphics and plotting utility.

Ultraplan's features include independent column widths, help screens and the ability to link spreadsheets. The program's plotting features allow you to produce bar and line graphs and pie charts.

Ultraplan is available on disk for $59.95. Datasoft, Inc., 19808 Nordhoff Place, Chatsworth, CA 91311.

Check Reader Service number 407.

Terminal Program with Built-in Editor

Oak Ridge Microcomputers (1948 Oak Ridge Turnpike, Oak Ridge, TN 37830) has released Omni Comm-II, a terminal program for the C-64.

Omni Comm-II allows you to send, receive and edit information from remote computer systems. You can store or retrieve information on tape or disk, and you can also edit information with the program's built-in editor. Omni Comm-II's text files are compatible with word processors that use sequential files.

The program provides an on-line disk directory, limited help facilities and the ability to print files using the VIC-1525 printer.

Omni Comm-II is available on disk for $49.95.

Check Reader Service number 410.

The Math Teacher

The Math Teacher is a math tutorial program that drills students on the fundamentals of addition, subtraction, multiplication and division. It is designed for students in grades one through eight.

The student selects one of the four math operations, the number of math problems desired and one of four skill levels. The student's score is displayed at the end of each session.

The Math Teacher is available on cassette for the Commodore 64. It costs $29.95. Computer Technology Company, PO Box 7000-309, Redondo Beach, CA 90277.

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Program Development Tool

Computer Alliance (10730 White Oak Ave., Granada Hills, CA 91344) has released the Basic Compiler and Assembler (BASM), a program development tool for the Commodore 64.

BASM is designed to give you the advantages of both Basic and assembly language. It assembles standard 6502 assembly language and compiles Basic in the same program. Basic and assembly language can be mixed on the same line, and BASM will automatically distinguish one from the other.

BASM uses a dialect of Basic adapted to the assembly language environment. Basic statements are translated directly into assembly language.

BASM is available on disk with a retail price of $99.95.

Check Reader Service number 429.

Infiltrate the Fuehrer's Lair!

Muse Software (347 N. Charles St., Baltimore, MD 21201) has released a sequel to Castle Wolfenstein, a World War II action game where the player is a GI who must escape from Nazi interrogators.

In Beyond Castle Wolfenstein, your new mission takes you behind enemy lines. You must infiltrate Hitler's bunker in Berlin for an attempt on the Fuehrer's life.

Beyond Castle Wolfenstein is a stand-alone game that can be played without knowledge of the original Wolfenstein release. It is available on disk for the Commodore 64, with a retail price of $34.95.

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The Training Kit is available for the Commodore 64 and Apple IIe/IIc computers at computer retailers across North America. 800/521-5321 for the name of the dealer nearest to you. (In California call 800/255-9039.)

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HOW TO BECOME COMPUTER LITERATE.

FEATURES	COMMODORE 64™	APPLE IIe™	IBM PC jr™	ATARI 800XL™
Price*	$219	$699	$669	$299
Built-in Memory	64K	64K	64K	64K
Typewriter Keyboard	YES (66 Keys)	YES (62 Keys)	"CHICKLET" (62 Keys)	YES (61 Keys)
Upper/Lower Case	YES	YES	YES	YES
Programmable Function Keys	YES	NO	YES	NO
AUDIO				
Polyphonic Tones	YES	NO	YES	YES
Music Synthesizer	YES	NO	NO	NO
Hi-Fi Output	YES	NO	YES	YES
VIDEO				
TV Output	YES	EXTRA COST	EXTRA COST	YES
Video Monitor Output	YES	YES	EXTRA COST	YES
INPUT/OUTPUT				
Intelligent I/O Bus	YES	NO	NO	YES
RS-232 Communications	YES**	EXTRA COST	YES**	EXTRA COST
"Smart" Peripherals	YES	NO	NO	YES

*Prices shown are common retail and may vary slightly in different markets.
**Requires an adapter to operate.

First you need the right input.

Like $219. That's what the Commodore 64™ costs. It's about one third the price of the Apple IIe™ or the IBM® PCjr.™

And 64K. That's how much memory the Commodore 64 has. It's also how much memory Apple IIe and the IBM PCjr have.

This computer lesson is brought to you as a public service by Commodore (certainly not by Apple or IBM), the only computer company that can afford to show you a chart like the one above.

But what you can't see above are the thousands of software programs that make the Commodore 64 fully capable of doing anything any "triple the price" computer can do; for fun or profit, for every member of the family; anything from soccer to spread sheets to space exploration.

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